PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : G06F 17/22, 17/21

A1

(11) International Publication Number: **WO 99/35593**

(43) International Publication Date: 15 July 1999 (15.07.99)

(21) International Application Number: PCT/US99/00279

(22) International Filing Date: 7 January 1999 (07.01.99)

(30) Priority Data:

60/070,720	7 January 1998 (07.01.98)	US
60/075,123	13 February 1998 (13.02.98)	US
09/107,941	30 June 1998 (30.06.98)	US

(81) Designated States: CA, JP, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(71) Applicant: MICROSOFT CORPORATION [US/US]; One Microsoft Way, Redmond, WA 98052-6399 (US).

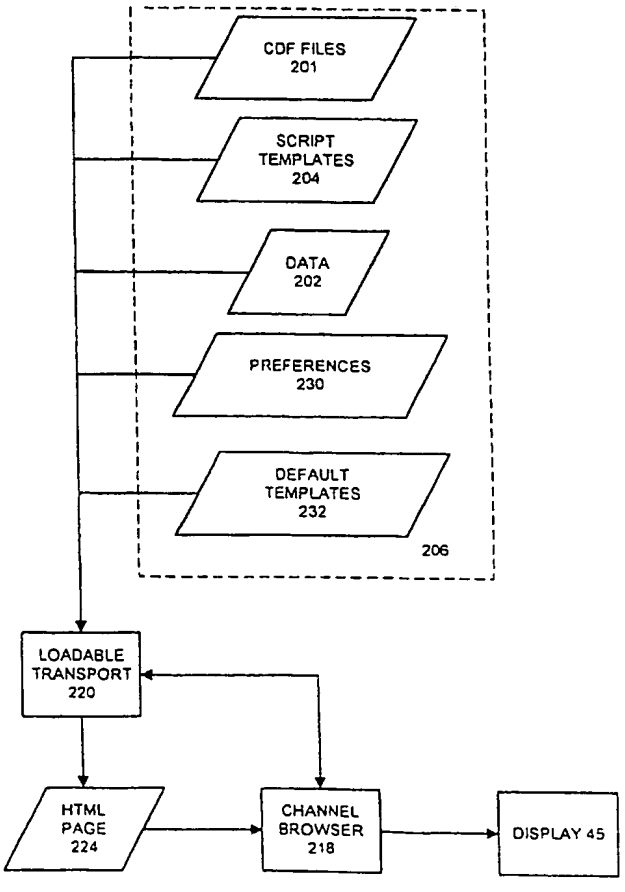
(72) Inventors: WECKER, Dave; 23908 22nd Drive S.E., Bothell, WA 98021 (US). TUNIMAN, David; 23044 N.E. 61st Street, Redmond, WA 98053 (US).

(74) Agents: KOEHLER, Steven, M. et al.; Westman, Champlin & Kelly, P.A., International Centre, Suite 1600, 900 Second Avenue South, Minneapolis, MN 55402-3319 (US).

(54) Title: CHANNEL DEFINITION ARCHITECTURE EXTENSION

(57) Abstract

A method for rendering information, such as, available through the Internet on a computer includes storing a content structure file (201), a data file (202) and a script file (204). The data file (202) includes data indicative of the information and the script file (204) includes script information indicative of a desired form in which the data is to be rendered. The content structure file (201), data file (202) and script file (204) are independently receivable by the computer (9). The content structure file (201) is read to ascertain which script in the script file (204) is associated with data to be rendered. The data from the data file (202) is retrieved and the associated script file (204) is executed to render the data. Instructions can be provided on a computer readable medium to implement the method.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania
AM	Armenia
AT	Austria
AU	Australia
AZ	Azerbaijan
BA	Bosnia and Herzegovina
BB	Barbados
BE	Belgium
BF	Burkina Faso
BG	Bulgaria
BJ	Benin
BR	Brazil
BY	Belarus
CA	Canada
CF	Central African Republic
CG	Congo
CH	Switzerland
CI	Côte d'Ivoire
CM	Cameroon
CN	China
CU	Cuba
CZ	Czech Republic
DE	Germany
DK	Denmark
EE	Estonia
ES	Spain
FI	Finland
FR	France
GA	Gabon
GB	United Kingdom
GE	Georgia
GH	Ghana
GN	Guinea
GR	Greece
HU	Hungary
IE	Ireland
IL	Israel
IS	Iceland
IT	Italy
JP	Japan
KE	Kenya
KG	Kyrgyzstan
KP	Democratic People's Republic of Korea
KR	Republic of Korea
KZ	Kazakstan
LC	Saint Lucia
LI	Liechtenstein
LK	Sri Lanka
LR	Liberia
LS	Lesotho
LT	Lithuania
LU	Luxembourg
LV	Latvia
MC	Monaco
MD	Republic of Moldova
MG	Madagascar
MK	The former Yugoslav Republic of Macedonia
ML	Mali
MN	Mongolia
MR	Mauritania
MW	Malawi
MX	Mexico
NE	Niger
NL	Netherlands
NO	Norway
NZ	New Zealand
PL	Poland
PT	Portugal
RO	Romania
RU	Russian Federation
SD	Sudan
SE	Sweden
SG	Singapore
SI	Slovenia
SK	Slovakia
SN	Senegal
SZ	Swaziland
TD	Chad
TG	Togo
TJ	Tajikistan
TM	Turkmenistan
TR	Turkey
TT	Trinidad and Tobago
UA	Ukraine
UG	Uganda
US	United States of America
UZ	Uzbekistan
VN	Viet Nam
YU	Yugoslavia
ZW	Zimbabwe

CHANNEL DEFINITION ARCHITECTURE EXTENSION

BACKGROUND OF THE INVENTION

The present invention relates to personal mobile computing devices commonly known as mobile devices. More particularly, the present invention relates to a system and method for delivering and receiving information on a mobile device.

Mobile devices are small electronic computing devices often referred to as personal digital assistants. Many such mobile devices are hand held devices, or palm-size devices, which comfortably fit within the hand. One commercially available mobile device is sold under the trade name HandHeld PC (or H/PC) having software provided by Microsoft Corporation of Redmond, Washington.

Generally, the mobile device includes a processor, random access memory (RAM), and an input device such as a keyboard and a display. The keyboard can be integrated with the display, such as where the keyboard is incorporated as a touch sensitive display. A communication interface is optionally provided and is commonly used to communicate with a desktop computer. A replaceable or rechargeable battery powers the mobile device. Optionally, the mobile device can receive power from an external power source that overrides or recharges the built-in battery.

In some prior applications, the mobile device is used in conjunction with a desktop computer. For example, the user of the mobile device may also have access to, and use, a desktop computer at work or at home, or both. The user typically runs the same types of applications on both the desktop computer and on the mobile device. Thus, it is quite advantageous for

the mobile device to be designed to be coupled to the desktop computer to exchange information with, and share information with, the desktop computer.

Another technique for providing information to such mobile devices is through a wireless transmission link. Such information can include electronic mail or news, weather, sports, traffic and local event information. The information is typically obtained from a desktop computer connected to the Internet and delivered over a wired connection. However, it may be desirable to deliver such information over a wireless connection as well. A wireless receiver on the mobile device can act to receive information as it is being sent to the mobile device.

There is presently no reasonable way to deliver push style content (such as hypertext mark-up language (HTML) content provided on a global network such as the internet and world wide web) to such devices in a wireless manner and in an open and available architecture. The bit rate of conventional wireless channels is very low. Thus, the delivery of very large content (such as HDML content) is highly impractical.

One conventional type of approach to delivering such information is to rewrite the content into a device friendly format, such as HTML. The content is then obtained over a pull-style model. Another approach currently being used to deliver information via a wireless medium in a closed model. In a closed model, a content provider can only provide content which is written in a format suitable for receipt by a specific device implementing a specific type of software. This means that the vast majority of web content is unavailable for viewing on such devices.

SUMMARY OF THE INVENTION

A method for rendering information, such as, available through the Internet on a computer includes storing a content structure file, a data file and a script file. The data file includes data indicative of the information and the script file includes script information indicative of a desired form in which the data is to be rendered. The content structure file, data file and script file are independently receivable by the computer. The content structure file is read to ascertain which script in the script file is associated with data to be rendered. The data from the data file is retrieved and the associated script file is executed to render the data. Instructions can be provided on a computer readable medium to implement the method.

In one preferred embodiment, the content structure file includes references to data and scripts in a hierarchy. In particular, the content structure file includes script tags associated with the scripts in the script file wherein the script tags are arranged in the hierarchy. When the content structure file is read to ascertain which script in the script file is associated with the data to be rendered, the script is chosen as a function of the hierarchy. Organization of the script tags in a hierarchy allows tag inheritance. Specifically, if there is no associated script tag for the data in the lower portion of the hierarchy, a script referenced by a script tag in a higher portion of the hierarchy will be executed to render the data. In another embodiment, if a referenced script in the content structure file cannot be found in the script file, a default script

is executed in order to render the data.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a simplified block diagram illustrating one embodiment of a mobile device in a system in accordance with the present invention.

FIG. 2 is a more detailed block diagram of one embodiment of a mobile device shown in FIG. 1.

FIG. 3 is a simplified pictorial illustration of one embodiment of the mobile device shown in FIG. 2.

FIG. 4 is a simplified pictorial illustration of another embodiment of the mobile device shown in FIG. 2.

FIG. 5 is a block diagram of one embodiment of a desktop computer in accordance with one aspect of the present invention.

FIG. 6 is a flow diagram illustrating the operation of a mobile device in accordance with one aspect of the present invention.

FIG. 7 is a simplified block diagram of FIG. 6.

FIG. 8 is a diagrammatic illustration of a graphical user interface rendered by the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 illustrates a system 10 in which the present invention is illustratively implemented. System 10 includes content provider 12, wireless carrier 14, desktop computer 16 and mobile device 18. Content provider 12 provides any suitable type of data from a database or other data source. For example, content provider 12 is discussed hereinafter as a provider of internet world wide web content. In the preferred embodiment, the content is provided in a standard format, such as HTML, JPEG, GIF, WAV, etc.

The web content is also preferably described in a content structure file also known commonly as a channel definition format (CDF) file. A single portion of content (such as a web page or a web site) is referred to herein as a mobile channel.

A mobile channel is a self describing web site that contains all the information necessary for efficient download of web content to mobile device 18. Three components are provided in a preferable mobile channel. The components include a channel definition format (CDF) file, a set of script files to render the channel, and a set of data files to be rendered. The CDF files are described in greater detail below. Briefly, the CDF is an inventory of content contained on the mobile channel.

The script files contain script which defines templates which specify the appearance of the data on the screen of mobile device 18. Scripts are preferably written in visual basic script (VBS).

The data files correspond to one or more script files and include data which is indicative of the substantive content of the channel to be rendered. The data is packaged in small and simple text files. All of this information is used to define web content.

Operation of system 10 using separate script and data files is described in detail in co-pending U.S. Patent Application, Serial No. 09/107,666 filed June 30, 1998, entitled " SYSTEM FOR DELIVERING DATA CONTENT OVER A LOW BIT RATE TRANSMISSION CHANNEL" , and hereby incorporated by reference. Briefly, however, wireless carrier 14 is configured to receive web content from the web content provider 12 via dial-up or direct internet connection, or a network connection. Wireless

carrier 14 also includes a wireless push server 20. Server 20 splits the content received from content provider 12 into pieces which are compatible with the particular type of transport being used by wireless carrier 14. For instance, server 20 may split the data such that it conforms to maximum packet size constraints, character set requirements, etc. for the channel type or transport type being used. Prior to transmission, the data is preferably translated to a different form. Translation may include compression, encryption, encoding and then packaging.

Once the data has been split appropriately such that it conforms to the transport constraints, the data is then configured for transmission over the air through a wireless network (such as through a paging channel) to be received directly on mobile device 18. The transmitted data is received by a wireless receiver and driver component 22 on mobile device 18 where the data is prepared for use by mobile device 18.

Mobile device 18 can also includes a modem 24. Thus, rather than being transmitted through wireless carrier 14, the web content can be transmitted directly from web content provider 12 through a direct dial-up modem connection to mobile device 18.

Desktop computer 16 will also be described in greater detail later in the specification. Briefly, however, desktop computer 16 is preferably provided with a standard web browser, such as Internet Explorer 4.0 commercially available from the Microsoft Corporation of Redmond, Washington. That being the case, the users of desktop 16 can preferably subscribe to channels in a standard fashion which provide the

user with certain channel content which can be browsed off-line or on-line. Desktop computer 16 is preferably provided with a loadable transport that accesses the script files and acts on the corresponding data file (in accordance with the script) to render the content where desktop computer 16 renders the data. Desktop computer 16, through the transport, can periodically retrieve or receive new and updated script, data and CDF files either for further transmission to mobile device 18 or simply for rendering the data. The script, data and CDF files can be transmitted either together or independently of one another. Since scripting files typically need updating much less frequently than the data files, this provides the user with the ability to view the web content on the desktop (off-line) while requiring only small amounts of bandwidth for incremental updating of the data files.

Desktop computer 16 also preferably includes synchronization component 26. Briefly, synchronization component 26 is configured to interact with a similar synchronization component 28 on mobile device 18 such that files which are the subject of synchronization can be synchronized from desktop computer 16 to mobile device 18, or vice versa. Once synchronized, both files (those on computer 16 and mobile device 18) contain up to date information.

More specifically, mobile device 18, in the preferred embodiment, can be synchronized with either desktop computer 16, or another mobile device 18, or both. In that instance, properties of objects stored in an object store on mobile device 18 are similar to properties of other instances of the same object

stored in an object store on desktop computer 16 or another mobile device 18. Thus, for example, when a user changes one instance of an object stored in an object store on desktop computer 16, the second instance of that object in the object store of mobile device 18 is updated the next time mobile device 18 is connected to desktop computer 16 so that both instances of the same object contain up-to-date data. This is referred to as synchronization.

In order to accomplish synchronization, synchronization components 26 and 28 run on both mobile device 18 and desktop computer 16 (or another mobile device 18). The synchronization components communicate with one another through well defined interfaces to manage communication and synchronization.

Mobile device 18 is also preferably provided with a script interpreter which, in one preferred embodiment, is the same as or similar to the loadable transport on desktop computer 16. Such a transport may be, for example, a down-sized visual basic interpreter, which receives and interprets the formatting script. The script is associated with a certain data file (typically a text file) that holds the raw data for the web content. Thus, the script interpreter operates on the data associated with a given script to provide a rendering of the web content to the user of mobile device 18.

By separating the script from the data in the web content, web content can be transmitted to mobile device 18 over very low bit rate channels. The script will only typically need to be transmitted very infrequently. Also, since an individual file is

typically much smaller than the script files, the data can be updated quite frequently, giving the user of mobile device 18 updated web content information, without transmitting new script. Thus, the separation of the script and data allows the transmission of web content information in a very efficient manner over low bit rate channels.

It is worth noting that, in the preferred embodiment, while mobile device 18 can be coupled to desktop computer 16, it can be also coupled to another mobile device 18. This connection can be made using any suitable, and commercially available, communication link and using a suitable communications protocol. For instance, in one preferred embodiment, mobile device 18 communicates with either desktop computer 16 or another mobile device 18 with a physical cable which communicates using a serial communications protocol. Other communication mechanisms are also contemplated by the present invention, such as infra-red (IR) communication or other suitable communication mechanisms.

FIG. 2 is a more detailed block diagram of mobile device 18. Mobile device 18 preferably includes microprocessor 30, memory 32, input/output (I/O) components 34, desktop communication interface 36 wireless receiver 37 and antenna 39. In a preferred embodiment, these components of mobile device 10 are coupled for communication with one another over a suitable bus 38.

Memory 32 is preferably implemented as non-volatile electronic memory such as random access memory (RAM) with a battery back-up module (not shown) such that information stored in memory 32 is not lost

when the general power to mobile device 18 is shut down. A portion of memory 32 is preferably allocated as addressable memory for program execution, while another portion of memory 32 is preferably used for storage, such as to simulate storage on a disc drive.

Memory 32 includes operating system 40, an application program 42 (such as a personal information manager or PIM) as well as an object store 44. During operation, operating system 40 is preferably executed by processor 30 from memory 32. Operating system 40, in one preferred embodiment, is a Windows CE brand operating system commercially available from Microsoft Corporation. The operating system 40 is preferably designed for mobile devices, and implements database features which can be utilized by PIM 42 through a set of exposed application programming interfaces and methods. The objects in object store 44 are preferably maintained by PIM 42 and operating system 40, at least partially in response to calls to the exposed application programming interfaces and methods.

I/O components 34, in one preferred embodiment, are provided to facilitate input and output operations from a user of mobile device 18. I/O components 34 are described in greater detail with respect to FIGS. 3 and 4.

Desktop communication interface 36 is optionally provided as any suitable communication interface. Interface 36 is preferably used to communicate with desktop computer 16, content provider 12, wireless carrier 14 and optionally another mobile device 18, as described with respect to FIG. 1. Thus, communication interface 36 preferably includes synchronization components 28 for communicating with desktop computer

16 and modem 24 for communicating with content provider 12. Wireless receiver and driver 22 are used for communicating with wireless carrier 14.

FIG. 3 is a simplified pictorial illustration of one preferred embodiment of a mobile device 10 which can be used in accordance with the present invention. Mobile device 10, as illustrated in FIG. 3, can be a desktop assistant sold under the designation H/PC having software provided by the Microsoft Corporation. In one preferred embodiment, mobile device 18 includes a miniaturized keyboard 43, display 45 and stylus 46. In the embodiment shown in FIG. 3, display 45 is a liquid crystal display (LCD) which uses a contact sensitive display screen in conjunction with stylus 46. Stylus 46 is used to press or contact the display 45 at designated coordinates to accomplish certain user input functions. Miniaturized keyboard 43 is preferably implemented as a miniaturized alpha-numeric keyboard, with any suitable and desired function keys which are also provided for accomplishing certain user input functions.

FIG. 4 is another simplified pictorial illustration of the mobile device 18 in accordance with another preferred embodiment of the present invention. Mobile device 18, as illustrated in FIG. 4, includes some items which are similar to those described with respect to FIG. 3, and are similarly numbered. For instance, mobile device 18, as shown in FIG. 4, also includes touch sensitive screen 45 which can be used, in conjunction with stylus 46, to accomplish certain user input functions. It should be noted that the display 45 for the mobile device as shown in FIGS. 3 and 4 can be the same size as one

another, or different sizes from one another, but would typically be much smaller than a conventional display used with a desktop computer. For example, displays 45 shown in FIGS. 3 and 4 may be defined by a matrix of only 240X320 coordinates, or 160X160 coordinates, or any other suitable size.

The mobile device 18 shown in FIG. 4 also includes a number of user input keys or buttons (such as scroll buttons 47) which allow the user to scroll through menu options or other display options which are displayed on display 45, or which allow the user to change applications, without contacting display 45. In addition, the mobile device 18 also shown in FIG. 4 also preferably includes a power button 49 which can be used to turn on and off the general power to the mobile device 18.

It should also be noted that, in the embodiment illustrated in FIG. 4, mobile device 18 includes a hand writing area 51. Hand writing area 51 can be used in conjunction with stylus 46 such that the user can write messages which are stored in memory 42 for later use by the mobile device 18. In one illustrative embodiment, the hand written messages are simply stored in hand written form and can be recalled by the user and displayed on the display screen 45 such that the user can review the hand written messages entered into the mobile device 18. In another preferred embodiment, mobile device 18 is provided with a character recognition module such that the user can enter alpha-numeric information into mobile device 18 by writing that alpha-numeric information on area 51 with stylus 46. In that instance, character recognition module in the mobile device 18 recognizes

the alpha-numeric characters and converts the characters into computer recognizable alpha-numeric characters which can be used by the application programs 42 in mobile device 18.

FIG. 5 and the related discussion are intended to provide a brief, general description of a suitable desktop computer 16 in which portions of the invention may be implemented. Although not required, the invention will be described, at least in part, in the general context of computer-executable instructions, such as program modules, being executed by a personal computer 16 or mobile device 18. Generally, program modules include routine programs, objects, components, data structures, etc. that perform particular tasks or implement particular abstract data types. Moreover, those skilled in the art will appreciate that desktop computer 16 may be implemented with other computer system configurations, including multiprocessor systems, microprocessor-based or programmable consumer electronics, network PCs, minicomputers, mainframe computers, and the like. The invention may also be practiced in distributed computing environments where tasks are performed by remote processing devices that are linked through a communications network. In a distributed computing environment, program modules may be located in both local and remote memory storage devices.

With reference to FIG. 5, an exemplary system for implementing desktop computer 16 includes a general purpose computing device in the form of a conventional personal computer 16, including processing unit 48, a system memory 50, and a system bus 52 that couples various system components including the system memory

50 to the processing unit 48. The system bus 52 may be any of several types of bus structures including a memory bus or memory controller, a peripheral bus, and a local bus using any of a variety of bus architectures. The system memory 50 includes read only memory (ROM) 54 a random access memory (RAM) 55. A basic input/output system (BIOS) 56, containing the basic routine that helps to transfer information between elements within the desktop computer 16, such as during start-up, is stored in ROM 54. The desktop computer 16 further includes a hard disk drive 57 for reading from and writing to a hard disk (not shown) a magnetic disk drive 58 for reading from or writing to removable magnetic disk 59, and an optical disk drive 60 for reading from or writing to a removable optical disk 61 such as a CD ROM or other optical media. The hard disk drive 57, magnetic disk drive 58, and optical disk drive 60 are connected to the system bus 52 by a hard disk drive interface 62, magnetic disk drive interface 63, and an optical drive interface 64, respectively. The drives and the associated computer-readable media provide nonvolatile storage of computer readable instructions, data structures, program modules and other data for the desktop computer 16.

Although the exemplary environment described herein employs a hard disk, a removable magnetic disk 59 and a removable optical disk 61, it should be appreciated by those skilled in the art that other types of computer readable media which can store data that is accessible by a computer, such as magnetic cassettes, flash memory cards, digital video disks (DVDs), Bernoulli cartridges, random access memories (RAMs), read only memory (ROM), and the like, may also

be used in the exemplary operating environment.

A number of program modules may be stored on the hard disk, magnetic disk 59, optical disk 61, ROM 54 or RAM 55, including an operating system 65, one or more application programs 66 (which may include PIMs), other program modules 67 (which may include synchronization component 26), and program data 68. A user may enter commands and information into the desktop computer 16 through input devices such as a keyboard 70, pointing device 72 and microphone 74. Other input devices (not shown) may include a joystick, game pad, satellite dish, scanner, or the like. These and other input devices are often connected to the processing unit 48 through a serial port interface 76 that is coupled to the system bus 52, but may be connected by other interfaces, such as a sound card, a parallel port, game port or a universal serial bus (USB). A monitor 77 or other type of display device is also connected to the system bus 52 via an interface, such as a video adapter 78. In addition to the monitor 77, desktop computers may typically include other peripheral output devices such as speaker 75 and printers.

The desktop computer 16 may operate in a networked environment using logic connections to one or more remote computers (other than mobile device 18), such as a remote computer 79. The remote computer 79 may be another personal computer, a server, a router, a network PC, a peer device or other network node, and typically includes many or all of the elements described above relative to desktop computer 16, although only a memory storage device 80 has been illustrated in FIG. 4. The logic connections depicted

in FIG. 4 include a local area network (LAN) 81 and a wide area network (WAN) 82. Such networking environments are commonplace in offices, enterprise-wide computer network intranets and the Internet.

When used in a LAN networking environment, the desktop computer 16 is connected to the local area network 81 through a network interface or adapter 83. When used in a WAN networking environment, the desktop computer 16 typically includes a modem 84 or other means for establishing communications over the wide area network 82, such as the Internet. The modem 84, which may be internal or external, is connected to the system bus 52 via the serial port interface 76. In a network environment, program modules depicted relative to desktop computer 16, or portions thereof, may be stored in the remote memory storage devices. It will be appreciated that the network connections shown are exemplary and other means of establishing a communications link between the computers may be used.

Desktop computer 16 runs operating system 65 that is typically stored in non-volatile memory 54 and executes on the processor 48. One suitable operating system is a Windows brand operating system sold by Microsoft Corporation, such as Windows 95 or Windows NT, operating systems, other derivative versions of Windows brand operating systems, or another suitable operating system. Other suitable operating systems include systems such as the Macintosh OS sold from Apple Corporation, and the OS/2 Presentation Manager sold by International Business Machines (IBM) of Armonk, New York. Application programs are preferably stored in program module 67, in volatile memory or non-volatile memory, or can be loaded into any of the

components shown in FIG. 5 from a floppy diskette 59, CDROM drive 61, downloaded from a network via network adapter 83, or loaded using another suitable mechanism.

FIG. 6 is a block diagram illustrating the functional architecture of mobile device 18. FIG. 6 shows similar items to those previously shown in the specification. Similar items are similarly numbered. FIG. 6 illustrates that mobile device 18 receives web content information either via synchronization component 26, wireless receiver (radio receiver and driver) 22 or modem 24. In any of those cases, CDF files 201 as well as script templates and data files, indicated by blocks 204 and 202 are eventually provided to cache memory 206. Where the web content information is received through synchronization component 26, the CDF files 201, script templates 204 and data files 202 may not be encrypted or encoded or otherwise formatted in the same fashion as they are for transmission over a wireless or modem channel. Therefore, the CDF files 201, script templates 204 and data files 202 are provided directly to cache manager 208. Cache manager 208 receives the CDF files 201, script templates 204 and data files 202, and provides them to cache memory 206. Cache manager 208 includes memory manipulation and timing components as well as data transfer components, which are suitable for transferring the CDF files 201, script templates 204 and data files 202 to a particular location in cache memory 206, and to track that location.

If, on the other hand, the web content is received over wireless receiver and driver 22 or modem 24, additional processing steps must be undertaken

prior to caching the data. Wireless receiver and driver 22 is a physical layer that receives and filters messages and generates wake-up events to mobile device 18. In one preferred embodiment, the information transmitted is first translated (such as compressed, encrypted, encoded and packaged) before transmission. Thus, the data must be translated back to its original form prior to further use by mobile device 18. Therefore, the data is first provided to message router 210. Message router 210 acts to record the message and route the received message to a translation layer 209. In FIG. 6, translation layer 209 includes unpackager and joiner component 212, a group of additional translators collectively labeled 214 and a further routing component 216.

Unpackager and joiner block 212 acts to receive, unpack and order a group of packets being transmitted. The unpackager rejoins packets of any long messages which were split up by wireless carrier 14. The ordered data is provided to translation components 214.

Translation components 214 act to reformat or translate the data into appropriate form to be handled by content handler 216. For example, once the packets which comprise a message have been unpacked and rejoined by unpacker and joiner 212, translation components 214 may typically decompress, decrypt and decode those packets.

Content handler 216 delivers the unpacked, joined and translated message to the appropriate registered destination (i.e., to the appropriate application or other functional block) on mobile device 18. In the embodiment illustrated in FIG. 5, content handler 216

provides the information to cache manager 208 which stores it in cache 206.

When the user wishes to off-line browse the web content stored in cache 206, the user launches an appropriate application program indicated by channel browser block 218 in FIG. 5. Channel browser 218 preferably generates suitable user interfaces on display 45 which provide the user with the ability to choose a certain channel to be viewed.

Channel browser 218 is configured to interact with a loadable transport 220 which is, in turn, coupled to cache manager 208. In response to the user requesting to view information provided via the chosen channel, loadable transport 220 requests cache manager 208 to retrieve the corresponding web content information (in the form of script templates and data files) from cache 206. The desired script templates 204 and data files 202 are provided from cache manager 208 to loadable transport 220.

The script interpreter in transport 220 is preferably a visual basic script interpreter which interprets script templates 204 and acts on data files 202 as a function also of the CDF file 201 to provide a desired rendering of the web content. In the embodiment illustrated in FIG. 5, the web content is rendered as a conventional hypertext mark-up language (HTML) page 224. Loadable transport 220 then provides the HTML page 224 rendering to channel browser 218 for viewing by the user of mobile device 18 on display 45.

The system 10 allows logging of desired information for use by content provider 12. In other words, by providing an entry in the CDF file 201, the content providers can tag certain items which they

want to track (i.e., they can tag certain items for which they would like to know when, and for how long, those items were viewed by any given user).

For example, when the user launches channel browser 218, and requests information from loadable transport 220, loadable transport 220 determines whether the requested information includes the appropriate CDF tag indicating that the content provider wishes to log information regarding the time and duration which the information was viewed. If so, loadable transport 220 logs information which is representative of the time and duration that the information was viewed by the user. This information is stored in cache 206 in a location which corresponds to that particular web content information.

The next time mobile device 18 is synchronized with desktop computer 16, not only is mobile device 18 updated with the current web content received by desktop computer 16, but desktop computer 16 is updated with the current logging information maintained by mobile device 18. Similarly, the next time the browser on desktop computer 16 accesses the appropriate web content from content provider 12, the logging information is transmitted from desktop computer 16 to content provider 12. In one preferred embodiment, since the browser on desktop computer 16 is Internet Explorer 4.0, logging information which has been synchronized to desktop computer 16 is transmitted to content provider 12 when the scheduler of Internet Explorer 4.0 is next invoked on desktop computer 16.

FIG. 7 is a simplified block diagram of a portion of FIG. 6 focusing on those components used to access

data stored on the mobile device 18 for display to the user through the display 45. In FIG. 7, the CDF files 201, data 202, script templates 204 and preferences 230, discussed below, are shown as part of cache 206.

One aspect of the present invention includes use of the CDF files 201 for construction of HTML pages 224. In particular, HTML pages 224 combine the script templates 204 and data 202 using structural information contained in the CDF files 201. For example, a particular script template 204 determines what subchannel of a CDF file 201 is being displayed and obtains the title and logo for that subchannel from the CDF file 201, incorporating them into the HTML page 224. In addition, particular data items such as an article or picture and/or additional subchannels within the subchannel can be obtained from the CDF file 201 to present an index to the subchannel being displayed. Typically, since items will change frequently as new data is obtained, item titles for the HTML page 224 can be obtained directly from the data stored in the data 202. Although this method of blending script templates 204, data 202 and CDF files 201 is more complex than conventional systems and methods where full HTML pages are transferred from a server to a client, this method is beneficial. In particular, the present system and method is able to deliver content in small segments of data instead of full HTML pages. This incremental approach makes it efficient and economical to update time-critical information, such as stock market values during peak network hours. The system and method also allows the use of default script templates 232 stored in the cache 206. The default script templates 232 can be

used to render channel content (i.e. subchannels and data) if a particular script template is missing.

CDF is a standard for creating " channels" for use with browsers such as Internet Explorer 4.0. The CDF standard is based on the Extensible Markup Language (XML). One aspect of the present invention includes additional tags to extend CDF for improved use on mobile devices. Specifically, the additional tags are used to navigate through the CDF files 201 when content is to be displayed on the display 45 in order to reduce the necessary storage space on the mobile device 18. Table 1 below is an example of a CDF file in accordance with the present invention.

TABLE 1

```
-       <!-Declare item scripts -->
        <ITEM HREF="Http://www.microsoft.com/test/script1.mcs" ID="IS1">
              <USAGE VALUE="None"/>
K       </ITEM>
        <ITEM HREF="Http://www.microsoft.com/test/script2.mcs" ID="IS2">
              <USAGE VALUE="None"/>
        </ITEM>

-       < -- Declare channel scripts -->
        <ITEM HREF="Http://www.microsoft.com/test/script3.mcs" ID="CS1">
              <USAGE VALUE="None"/>
J       </ITEM>
        <ITEM HREF="Http://www.microsoft.com/test/script4.mcs" ID="CS2">
              <USAGE VALUE="None"/>
-       </ITEM>

    A   <CHANNEL HREF = "mctp://www.microsoft.com/test/test.cdf" ID="test"

    C   BASE ="http://www.microsoft.com/test/
    B   SELF ="http://www.microsoft.com/test.cdf/>

              <TITLE VALUE = "Test Channel" />
              <!-IS1 is the general item script to use within the channel  -->
              <ITEMSCRIPT VALUE="IS1"/>

              <!-CS1 is the general channel script to use within the channel  -->
              <CHANSCRIPT VALUE = "CS1"/>

    E         <ITEM HREF = "Http://www.microsoft.com/test/AD1.mad" ID="AD1">
                    <USAGE VALUE = "MobileAd"/>
              <ITEM>
              <ITEM HREF = "Http://www.microsoft.com/test/AD2.mad" ID-"AD2">
                    <USAGE VALUE = "MobileAd"/>
              <ITEM>

    G         <CHANNEL ID = "C1" DEFAULTPREF = "ON">
                  <TITLE VALUE = "Test Subchannel 1" />

                  -This subchannel is also rendered by the general channel script
                   CS1 -->

                  <ITEM HREF="http://www.microsoft.com/test/item-a.mcd" ID="ITA">
                  <!-This item is rendered by the item-specific IS2 script -->
                        <ITEMSCRIPT VALUE="IS2"/>
                        <USAGE VALUE="MOBILECHANNEL"/>
                  </ITEM>
                    ......

             </CHANNEL>
    H        <CHANNEL ID = "C2" DEFAULTPREF = "OFF">
                  <TITLE VALUE = "Test Subchannel 2" />

                  -This subchannel is rendered by the channel-specific script CS2
    -->
                        <CHANSCRIPT VALUE = "CS2" />
                        <ITEM HREF="http://www.microsoft.com/test/item-b.mcd"
                         ID="ITB">
                        <!-This item is also rendered by the general IS1 item
                         script -->

                        <USAGE VALUE="MOBILECHANNEL"/>
                </ITEM>
        </CHANNEL>
        </CHANNEL>
```

Referring to Table 1, the path of the CDF is present in two attributes of the top-level " CHANNEL" tag that is standard in CDF files. In particular, the " HREF" attribute, indicated at "A" references the CDF path using the transport protocol of the loadable transport 220 (FIG. 6), for example, a Mobile Channels Transport Protocol (MCTP) can be used. The HREF attribute uses the MCTP prefix to indicate the CDF file is for a mobile device 18. If the CDF file is present on the desktop computer 16 (FIG. 1) rather than on the mobile device 18, the MCTP prefix can invoke special processing when referenced by the browser used on the desktop computer 16. Unlike the HREF attribute as used by browsers such as Internet Explorer 4.0 on the desktop computer 16, the URL does not directly indicate the page to render. Rather, the attribute references the top-level channel as specified by the CDF file.

The " SELF" attribute "B" references the CDF path using the standard HTTP prefix. Unlike standard implementation of the CDF on the desktop computer 16, the SELF attribute is preferably used with the top-level CHANNEL tag.

The " BASE" attribute "C" has the same functionality in the CDF file of the present invention as it does for use in a browser on the desktop computer 16. Its URL is an HTTP URL. In the example illustrated, the HREF attribute "A" for the top-level CHANNEL tag is the only one that has a transport protocol-style URL. All other HREF attribute values are of the HTTP-style

Several attributes and attribute values that may appear in the CDF files 201 according to the present

invention appear in standard CDF tags. The tags are described in the following table.

TABLE 2

ID	A short string identifier for the CHANNEL, ITEM, and LOGO elements.
DEFAULTPREF	A Boolean operator indicating the suggested preference setting for a CHANNEL element. Values include "On" or "Off".
USAGE	New usage values "MobileChannel", "MobileDesktopComputer" and "MobileAD".
CHANNEL	CHANNEL element may take a USAGE tag specifying either the "MobileChannel or "MobileDesktop Computer" USAGE values defined above. It is required for the top-level CHANNEL element of a Mobile Desktop Component.

Each tag or attribute is discussed in detail below:

" ID"

An ID tag is a text string used as an attribute to identify the specified element. An ID tag must be provided for all CHANNEL, ITEM, and LOGO elements in a mobile channel.

ID = " ChanId"
ID = " ItemId"
ID = " LogoId"

An ID tag is used for short and quick references both within the CDF file 201 and within the script templates 204. Within the CDF file 201, the ID tag is used as a value for both CHANSCRIPT and ITEMSCRIPT, discussed below, tags to refer to the associated ITEM tag that represents the script template 204.

Within the script template 204, the ID tag is used, along with the MCTP discussed below, to form unique URLs. The ID tag is used by the loadable

transport 220 to uniquely reference a channel or item. MCTP references are of the form

" mctp://Cdfid/ChanID" for a channel or

" mctp://CDFid/ItemID" for an item.

In one embodiment, the string length of an ID tag is kept to the minimum necessary to uniquely define it within the CDF over time. Keeping the ID string length short is important in order to conserve network bandwidth and storage space.

In the CDF file 201, the ID tag of the top-level channel is used as a handle to the channel. In one embodiment, the maximum length of the ID string is 64 characters, but a handle of between 6 and 10 characters is recommended for the top-level ID to be unique. The following are three code examples.

```
<CHANNEL ID    = " Sports" >
<ITEM HREF     = " www.microsoft.com/test/sports/article001.mcd"
         ID    = " Art1" >
<LOGO HREF     = " www.microsoft.com/test/sports/sportslogo.gif"
        STYLE  = " IMAGE"
           ID  = " L_Sports" >
```

The ID tag is preferred for each parent element and can be of a single occurrence.

"USAGE"

For the USAGE tag, three new values are provided:

(1) MobileChannel

The statement,

<USAGE Value = " MobileChannel" />

specifies the channel as a channel or a data item as for use with the mobile device 18. The top-level channel should be given a USAGE value of " MobileChannel" . When the USAGE value is set to " MobileChannel" , items will be recognized by the channel browser 218 and displayed on the display 45 of

the mobile device 18 but not recognized by a channel browser on the desktop computer 16. This feature makes it possible to properly display special data items (having the file extension ".mcd") on the mobile device 18 and to ignore them when the CDF 201 is used with the desktop computer 16. For example,

```
<ITEM HREF=" http//www.microsoft.com/test1.mcd"  ID=" T1"
        <USAGE VALUE = " MobileChannel/>
</ITEM>
<ITEM HREF=" http//www.microsoft.com/test2.mcd"  ID=" T2"
        <USAGE VALUE = " None/>
</ITEM>
```

Item T1 above is a data item for the mobile device 18 and will be recognized by the channel browser 218, but not by the channel browser on the desktop computer 16. Item T2 is a script and will not be recognized by the channel browsers for the mobile device 18 or the desktop computer 16 since the value equals " None" .

(2) MobileDesktopComponent

The statement

```
<USAGE VALUE = " MobileDesktopComponent" />
```

specifies the channel as a component viewable on the display 45 in conjunction with other applications such as personal information managers, for example, schedulers and electronic mail applications.

(3) MobileAd

The statement

```
< Usage value = " MobileAd" />
```

specifies an item as an advertisement viewable on the display 45. For the following example:

```
<ITEM HREF = http://www.microsoft.com/AD1.mad">
      <USAGE VALUE = "MobileAd">
</ITEM>
```

"AD1.mad" specifies the advertising to be displayed according to the script templates 204, discussed below. In the example of Table 1, two advertisements are defined in the top-level channel at "E". When the top-level channel is displayed on the display 45 according to the script template 204, one or both of the advertisements can also be displayed. In an alternative embodiment, the script template 204 can alternate display of the advertisements if more than one is present. In the example of Table 1, the advertisements are defined with respect to the top-level channel; however, a feature of the present invention allows the advertisements also to be displayed when the subchannels "C1" or " C2" are also displayed without having to repeat the syntax for the advertisements in the subchannel definition. As used herein, this feature is called "inheritance". If desired, new advertisements can be defined in the subchannels.

DEFAULTPREF

The DEFAULTPREF tag can be used as follows:

```
<CHANNEL
ID = " ChanId"
DEFAULTPREF = " ON"  | " OFF"
>
```

In the example of Table 1, the DEFAULTPREF tags are used at "G" and "H".

The DEFAULTPREF tag marks a subchannel with specific default preferences. In other words, the DEFAULTPREF tag controls which subchannels a user will receive content for by default. By default, when content for a new channel is provided to the mobile device 18 items within subchannels that are marked

with the attribute DEFAULTPREF = " OFF" are not transferred.

The feature allows the content provider 12 to create a channel that offers more content than can reasonably be accommodated by the limited storage resources available on the mobile device 18, and yet does not, by default, overwhelm the mobile device 18 with all of the channel's content. In one embodiment, the DEFAULTPREF tags are examined are stored at 230 when the channel is first provided to the mobile device 18. The user can change and store his or her preferences 230, as desired, to include more or less content than the DEFAULTPREF settings allow.

The DEFAULTPREF tag can have values of either " ON" or " OFF" . If DEFAULTPREF attribute is not specified, the mobile device 18 treats the subchannel as if it were marked with DEFAULTPREF = " ON" . The DEFAULTPREF tag can appear only once in a CHANNEL element.

In addition to the tags described above, which are present in CDF files of prior art, but now include new attributes, the CDF files 201 also include new tags for use with the script templates 204 and data 202. The new tags are described in the following table.

TABLE 3

Tag	Description
CHANSCRIPT	Identifies the ID of the script file to render the channel and subchannels.
ITEMSCRIPT	Identifies the ID of the script file to render the item data file.
ITEMFORMAT	Defines the file structure for data files.

Each tag is discussed in detail below:

CHANSCRIPT

The CHANSCRIPT tag is generally of the form:

```
<CHANSCRIPT VALUE = "ChannelID"/>
```

where "ChannelID" specifies the URL. In the example of Table 1, the script for display of a channel or a subchannel is denoted with a ".mcs" extension as indicated at "J". In one embodiment, "tag inheritance" is provided where the CHANSCRIPT tag value will apply to all channels or "child" channels of the current channel or subchannel. The subchannel CHANSCRIPT tag will supersede any CHANSCRIPT value previously defined by a higher or "parent" CHANNEL element. The VALUE attribute specifies the ID of the ITEM element corresponding to the script to be run to render this level of the channel. For example, in Table 1,

```
<CHANSCRIPT VALUE=CS1"/>
```

specifies use of a particular script template where the channel script identified by "CS1" has been defined in the beginning portion of the CDF file.

The top-level CHANNEL element can have at least one CHANSCRIPT tag as the child element. Each subchannel can have at most one such tag.

ITEMSCRIPT

The ITEMSCRIPT tag is generally of the form:

```
<ITEMSCRIPT VALUE = "ItemID"/>
```

where "ItemID" specifies the URL. In the example of Table 1, the script for display of an item is denoted with a ".mcs" extension as indicated at "K". In one embodiment, "tag inheritance' is provided where the ITEMSCRIPT tag value applies to all child items of the current channel or subchannel. Subchannel ITEMSCRIPT tag supersedes any ITEMSCRIPT value previously defined by a parent CHANNEL element. The VALUE attribute specifies the ID of the ITEM element corresponding to the script to run to render this level of the channel. For example, in Table 1,

```
<ITEMSCRIPT VALUE = "IS1" />
```

specifies a particular script template where the script identified by "IS1" was previously defined in the CDF. It should be noted that when the following statement:

```
<USAGE VALUE="NONE" />
```

appears in conjunction with a script file, the VALUE attribute of "None" for the USAGE tag prevents the script file from being displayed by the channel browser 218.

The top-most CHANNEL element can have at least one ITEMSCRIPT tag. At all other channel levels there can be at most one such tag.

ITEMFORMAT

The ITEMFORMAT tag is generally the form:

```
<ITEMFORMAT VALUE="header_block; repeat_block"/>
```

The tag specifies the format of a class of data items by identifying the associated file structure. The data items are simple text files that can have a unique header and a repeating block structure for record-oriented data. Helper functions are provided in the scripting environment to access the data content using information contained in the ITEMFORMAT tag. Both header_block and repeat_block are optional. But at least one or the other of the header_block or the repeat_block must exist. If repeat_block exists, it should be preceded by a delimiter such as a semi-colon (;) as indicated above. The header block typically contains the description about the data items. And the repeatable data block contains description about particular data items therein. The header_block and repeat_block are of the form:

Vi[=Ti], for i = 1 to n

Here "Vi" is the field name of the block value and "Ti" is the optional type of the block value. If "Ti" is omitted, a default value "HTML" is assumed. Valid types are listed in the following table:

TABLE 4

Type	Description
HTML	HTML text including markup.
TEXT	Same as HTML.
IMG	ID of image item in CDF files.
HREF	URL to a page, for example, data file and channel script.

A data block is merely a group of values. There is one value per line. Any meaningful data file should have at least one data block. For example, three data

blocks might be used to show a portfolio of three stocks. In the following example, a "Market" channel displays stock values listed in the "Stocks.mcd" file. The header gives the title and displays the data of the shown stocks. The data to be listed includes the name, the low price, high price, and closing prices of each stock.

```
<ITEM HREF="http://www.market.com/Stocks.mcs" ID="Stock_S"
   <USAGE VALUE="None"
</ITEM>
.....
<CHANNEL ID= "Stock_C">
   <TITLE VALUE="Market"/>
   <ITEM HREF="http://www.market.com/stocks.mcd"
   ID="Stock_D">
        <USAGE VALUE="MobileChannel"/>
        <ITEMSCRIPT VALUE="Stock_S"/>
        <ITEMFORMAT VALUE="Title,Date,Picture=IMG;
              Name, Low, High, Close"/>
   </ITEM>
 </CHANNEL>
```

Here the header block has three values, "Title", "Date" and "Picture", and the data block has four: "Name", "Low", "High" and "Close".

IMG indicates the field that represents an image, such as JPG or GIF. The field value is the identifier of the item defining the URL of the image. The built-in item script creates an IMG value to display this item.

The data block may be repeated to build a table of stock prices. If the Stocks.mcd file contains a single data block, the script displays a single stock per page. If it has multiple data blocks, the script could display a table of stocks.

The repeat block can be omitted, as shown in the

following example, which is represents a news article with a title, an image, and the body of text:

```
<ITEMFORMAT VALUE="TITLE, PICTURE=IMG, BODY"/>
```

The header block can also be omitted, as shown in the following example that represents a stock page with a listing of stocks. Note the presence of the semi-colon (;) to indicate the value list. It is, therefore, a repeat block and not a header block.

```
<ITEMFORMAT VALUE =", Name, Low, High, Close"/>
```

It should be noted that not all the standard tags are supported and used on the mobile devices 18. In particular, the CDF files 201 need not support any software update channel tags (EARLIESTTIME, INTERVALTIME, and LASTTIME tags) if the channel browser 218 is operated only in an "offline" mode. In addition, the LOGIN tag can be ignored. However, while the EARLIESTTIME, INTERVALTIME, and LASTTIME tags are ignored on the mobile device 18 when operated offline, they are supported if the mobile device 18 can be operated in an "on-line" mode. In addition, if the CDF file 201, script template files 204 and data file 202 structures is used on the desktop computer 16 or other similar device, the software update tags will be recognized and used to download the channel from the content provider 12.

Mobile Channels Data Files

The data files 202 are used to deliver incremental data for a channel. These are simple text files that contain data with one data item per line in the file. Within the CDF file 201, a structure for the data file may be declared using an ITEMFORMAT tag as discussed earlier.

In the example, each data file has a ".mcd" extension. The CDF file 201 includes an ITEM tag to define the "mcd" file. Within the ITEM tag, the ID attribute is used as a short-hand way to reference the "mcd" file from within the script without having to reference its complete URL.

Unlike the conventional script-drives approach, where script files are run and call for data to display, in the present system the opposite is performed for displaying incremental data. Because new information can come in at any time within a new "mcd" file, it is more efficient to activate the script template 204 to display data 202 when it arrives. This data-triggers-script approach has an added benefit in that it permits the inheritance of script templates.

The file format for data files 202 is flexible. It is simply a text file that contains the data, such as references to images with each item on a separate line. The present system exposes methods within the scripting environment for reading this content from the data file 202.

The ITEMFORMAT tag is used to specify the kind of data present in the file. Generally, files have the following format:

```
[Head Block]
[Data Block 1]
[Data Block 2]
...
[Data Block n]
```

As discussed above, the use of particular script templates 204 in the CDF files 201 are identified with the CHANNELSCRIPT and ITEMSCRIPT tags. The script templates 204 are invoked in a data-driven manner.

When it is time to display a particular data file 202, the reference is made to the data file 202 and the appropriate item script template is located to display it. Likewise, when it is time to show channel content, such as a listing a subchannels or data items, the reference to the channel is made and the appropriate channel script template is located to display it.

ITEMSCRIPT SELECTION

When it is necessary to render a particular data file 202 through the channel browser 218, the appropriate script template 204 must be selected. Item script templates are responsible for rendering data files and are invoked as a result of referencing the URL of the data file 202. The appropriate script template 204 is selected based upon the proximity of an ITEMSCRIPT tag to the particular data file 202 to be rendered 202 to be rendered.

In the embodiment illustrated, an item URL, as it appears in scripts, is in the following form:

```
Mctp://CDFid/ItemID
```

Here mctp specifies the use of Mobile Channels Transport Protocol to resolve the URL and to invoke the scripting engine. CDFid is the ID tag of the top-level CHANNEL element and is used to select the correct CDF file in the CDF files 201. ItemId is the ID tag of the ITEM element for the data file 202 to be rendered.

The data file appears in an ITEM element within the channel hierarchy. The location of the ITEM element relative to an ITEMSCRIPT tag determines which script template 204 will be used to render the data.

The script template 204 is identified by matching the ID value in the ITEMSCRIPT tag with the ID value of an ITEM element, which is the item for the script template 204, within the CDF file 201.

ITEMSCRIPT tags can be children of either CHANNEL elements or ITEM elements. An ITEMSCRIPT tag determines the script template 204 to be used for all items of the current channel and its subchannels, if no further ITEMSCRIPT tags are associated with the subchannels. An item script template 204, as identified by ITEMSCRIPT, for a CHANNEL or ITEM element supercedes any previously defined ITEMSCRIPT value.

Thus, an inheritance model is used. When it is necessary to render a particular data item, the nearest ITEMSCRIPT element in the hierarchy is used to determine what script template 204 should render the data. In the event that the appropriate script template 204 is not available on the mobile device 18, a built-in script template is used to render the data. The default item script template is stored at 232 and simply enumerates through all the fields specified in the ITEMFORMAT tag and for each one displays the appropriate data from the specified data file. If the data file contains a repeating block, all the block values are enumerated on the page in a list until the end of the data file is reached.

By convention, item script templates are specified at the top-level of a channel, usually at the top of the file as shown in Table 1. Each item script template is assigned a unique ID. The script can then be referenced using an ITEMSCRIPT element from any location in the CDF loadable transport 220,

rather than the usual HTTP protocol.

It should be noted that due to a limitation in the way standard channel browsers for the desktop computer 16 handles URLs for images, in order for an image to be rendered on the desktop computer 16 images should be referenced using standard HTTP references, rather than the loadable transport. If allowing the channel to be viewed, the desktop computer 16 is not important, then the loadable transport type URLs may be used.

CHANNEL SCRIPT SELECTION

In addition to rendering data from data files, such as a news article, it is usually necessary to render the current location within the CDF so that the user can navigate to the desired data. When it is necessary to render a CDF navigation page (i.e. the channel and/or subchannels) on the display 45, the appropriate script template must be selected. Channel script templates are responsible for rendering the CDF navigation pages supplied by the content provider 12. As with an item script template, referencing the URL of the subchannel results in the invocation of a channel script template. The appropriate script template is selected based upon the proximity of an CHANSCRIPT tag to the particular CHANNEL element in the URL.

A channel URL, as appears in script templates, is of the following form:

```
mctp://CDFid/ChanID
```

Here, mctp specifies the use of the loadable transport protocol to resolve the URL and to invoke the scripting engine. "CDFid" is the ID tag of the

top-level CHANNEL element. It is used to select the correct CDF file. "ChanId" is the ID tag of the CHANNEL element for the subchannel within the CDF to be rendered. As a user navigates through the channel, he or she is effectively moving up and down through the CDF channel hierarchy accessing data files. At each level in the channel hierarchy, it is possible to associate a script template to display the channel content, which is usually a list of subchannels or available items.

The CHANSCRIPT tag identifies the script template to be used to render the current channel location in a way similar to how the ITEMSCRIPT tag identifies the script template to render data. The location of a CHANNEL element relative to a CHANSCRIPT determines which script template will be used to render the subchannel. The script template is identified by matching the ID value in the CHANSCRIPT element with the ID value of an ITEM element, that is, the ITEM for the script template, within the CDF.

CHANSCRIPT tags are children of CHANNEL elements. A CHANSCRIPT tag determines the script template to be used for the current channel and its subchannels. A CHANSCRIPT tag specified for a CHANNEL element supercedes any previously defined CHANSCRIPT value.

Thus, an inheritance model is used. When it is necessary to render a particular subchannel, the nearest CHANSCRIPT tag upward in the hierarchy is used to determine what script template should render the data. In the event that the appropriate script template is not available on the mobile device 18, a built-in script template 232 is used to render the channel as best it can.

SCRIPTING

The script template specifies the layout and behavior of HTML pages. Script segments are enclosed between the "<%" and "%>" or "<%=" and "%>" delimiter pairs. The second pair of delimiters entails special use and meaning in the script template. In each script segment, there must be at least one valid executable, or non-comment, statement. There must also be at least one scripting segment in the mcs file. In one embodiment, any empty script segment generates a syntax error. Scripting segments can be freely intermixed with standard HTML text, provided that the script-generated, HTML output has the valid syntax within the context of the standard HTML display code. Appendix A provides an example of a CHANNELSCRIPT and an ITEMSCRIPT. Appendix B is a description of a scripting environment for use in the present system.

FIG. 8 illustrates an example of an index viewer user interface 240 for rendering content information using the CDF files 201, the script templates 204 and the data 202. The index viewer user interface 240 can cover the complete display 45 when the information is rendered, or alternatively, the index viewer user interface 240 can be a "pane" of a larger graphical user interface presented on the display 45.

In the exemplary embodiment of FIG. 5, the top-level channel is indicated at 242. The top-level channel 242 includes general subchannel categories, such as "News and Technology", "Sports", "Business", "Entertainment", "Life Style and Travel", "The Microsoft Network", and "MSNBC". Subchannels 244, 245, 246, 247, 248, 249 and 250 correspond to the first level subchannels "Test Subchannel 1" and Test

Subchannel 2" shown in the example of Table 1. Each of the subchannels 244-250 lead to further subchannels and/or data items. In the example of FIG. 5, the subchannel 245 includes further subchannels 252, 253, 254 and 255. In this example, subchannel 252 includes yet further subchannels generally indicated at 257 which, when accessed, will display the latest article pertaining to the listed subject heading. An indicator button 260 can be provided to the user when additional information is present but not shown. In this example, the indicator button 260 indicates that additional subchannels to the top-level channel 242 are present. A portion 264 of the user interface 240 can be set aside for advertisements.

To display the content information of the top-level channel 242, the channel browser 218 (FIG. 6) accesses the loadable transport 220 in order to locate the CDF file for the top-level channel 242 in the stored CDF files 201. By examining the CDF file for the top-level channel 242, the loadable transport 220 determines which script file will be executed from the script templates 204 in order to render the titles of the subchannel 244-250 illustrated in FIG. 8. It should be noted that the titles of the subchannels 244-250 are not contained in the script file that is executed, but rather, form a part of the CDF file for the top-level channel 242. Thus, the script file used to render the top-level channel 242 examines the CDF file for the top-level channel 242 in order to generate the HTML page 224 as provided to the channel browser 218. This allows general script files to be used rather than specific script files for each portion of the information that is rendered. As

discussed above, when a subchannel, such as subchannel 245, is rendered, a different script file can be called, or if one is not called, the script file used to generate the top-level channel 242 can be used. Again, when any of the subchannels 252-255 or 257 are to be rendered, the scripts executed will examine the CDF file for the top-level channel 242 in order to obtain relevant information that will be displayed as well as determine how the information is to be displayed in the hierarchy. Along with the script templates 204 and data 202, the CDF files 201 can be updated as desired.

Although the present invention has been described with reference to preferred embodiments, workers skilled in the art will recognize that changes may be made in form and detail without departing from the spirit and scope of the invention.

APPENDIX A

Example Channel Script

```
<html>
<%
    Set MC    = Server.CreateObject("MobileChannels.Utilities")
    URL       = Request.ServerVariables("URL")
    DataID    = Request.QueryString("DATAID")
    Pieces    = Split(URL,"/")
    ChanID    = Pieces(2)

'get logo and title of channel
  TopElem = MC.Locate(ChanID)
  ChanTitle = " "
  LogoHref = 0
  If TopElem Then
      ChanTitle = MC~Title(TopElem)
      LogoElem = TopElem
      LogoElem = MC.Navigate(LogoElem, "INMATCH", "LOGO")
      Do While LogoElem
          LogostyleElem = MC.Navigate(LogoElem, "IMMATCH", "STYLE")
          If LogoStyleElem Then
              If Strcomp(MC.value(LogoStyleElem),"IMAGE",l) = 0 Then
                      LogoHref = MC.Href(LogoElem)
                  If LogoHref Then
                      If MC.HrefExists(LogoHref) Then
                          Exit Do
                      Else
                          LogoHref = 0
                      End If
                  End If
              End If
          End If
```

```
            LogoElem = MC.Navigate(LogoElem, "NEXT")
                If LogoElem Then
                    LogoElem = MC.Navigate(LogoElem, "MATCH", "LOGD")
                End If
        Loop
    End If
    NeedTitle = 1
    Response.Write("<head><title>" & ChanTitle & "</title></head>")
    If LogoHref Then
        Response.Write("<body><a href=mctp://" & ChanID & ">
            <img src=" & LogoHref & "></a><br>  <br>")
    ElseIf ChanTitle And Len(ChanTitle) Then
        Response.Write("<body><a href=mctp://" & ChanID & ">
            <h3>" & ChanTitle & "</h3></a>")
        NeedTitle = 0
    Else
        Response.Write("<body>")
    End If
'decide whether you need a title for this chan/subchan
    If DataID And (DataID <> ChanID) Then
        NeedTitle = 1
    Else
DataID = ChanID
    Else If
    SubTitle = 0
    SubElem = MC.Locate(DataID)
    If SubElem Then
        SubTitle = MC.Title(SubElem)
        If SubTitle And NeedTitle Then
            Response.Write("<b>" & SubTitle & "</b><br> <br>")
        End If

'display contents of chan/subchan
        Response.Write("<table border=0 cellpadding=-2 cellspacing=-2>")
```

```
ChildElem = MC.Navigate(SubElem, "In")
Do While ChildElem
    ShowIt = 1
    IsChan = 0
    If MC.Tag(ChildElem) = "CHANNEL" Then
    IsChan = 1
        If Not MC.IsSubscribed(ChildElem) Then
            ShowIt = 0
        End If
    ElseIf MC.Tag(ChildElem) = "ITEM" Then
        VisparElem = MC.Navigate(ChildElem, "InMatch", "USAGE")
            If VisparElem Then
                Usage = MC.Value(VisFarElem)
                    If usage Then
                        If StrComp(Usage,"None",1) = 0 Then
                            ShowIt = 0
                        End If
                    End If
            End If
'be sure item exists
            If ShowIt Then
                ChildHref = MC.Href)ChildElem)
                 If ChildHref Then
                    If Not MC.HrefExists(ChildHref) Then
                        ShowIt = 0
                    End If
                Else
                    ShowIt = 0
                End If
             End If
        Else
            ShowIt = 0
        End If
          If ShowIt Then
```

```
'be sure you can get the ID
            IDVal = 0
            IDElem = MC.Navigate (ChildElem, "InMatch", "ID")
                If IDElem Then
                    IDVal       = MC.Value(IDElem)
                End If
                If Not IDVal Then
                    ShowIt = 0
                End If
        End If
    'get title
        If ShowIt Then
            ItemTitle = MC.Title(ChildElem)
            If Not ItemTitle Or (Len)ItemTitle) = 0)
                Then ShowIt = 0
            Else
                If Len(ItemTitle) > 26 Then
                    ItemTitle = Mid(ItemTitle,0,25) & ". . ."
                End If
            End If
        End If
    'You know what it is and are going to try to show it
        If ShowIt Then
            If IsChan Then
                Response.Write("<tr><td>*")
            Else
                Response Write ("<tr><td>")
                End If
            Response.Write("<td> <a href=mctp://" & ChanID & "/"
                & IDVal & ">" & ItemTitle & "</a")
        End If
        ChildElem           = MC.Navigate(ChildElm,"Next")
        Loop
        Response.Write("</table>")
```

```
    Else
        Response.Write("Data ID not found.")
    End If
%>

<br>  <br><hr>
<b>Note:</b> This page was automatically generated because the correct
scripts could not be found.  If this problem persists after
synchronization,
please contact the content provider.
</body>
</html>
```

Example Item Script

```
<html>
<%
    Set MC    = Server.CreateObject("MobileChannels.Utilities")
    URL       = Request.ServerVariables ("URL")
    DataID    = Request.QueryString("DATAID")
    Pieces    = Split(URL,"/")
    ChanID    = Pieces(2)

' get logo and title of channel
 TopElem = MC.Locate(ChanID)
 ChanTitle = " "
 LogoHref = 0
 If TopElm Then
    ChanTitle = MC.Title(TopElm)
    LogoElm = TopElem
    LogoElem = MC.Navigate(LogoElem,"INMATCH","LOGO")
 Do While LogoElem
    LogostyleElem = MC.Navigate(LogoElem,"INMATCH","STYLE")
        If LogoStyleElem Then
            If StrComp(MC.Value(LogoStyleElem),"IMAGE,1) = 0 Then
                LogoHref = MC.Href(LogoElem)
                If LogoHref Then
                    If MC.HrefExists(LogoHref) Then
                        Exit Do
                    Else
                        LogoHref = 0
                    End If
                End If
            End If
        End If
    LogoElem = MC.Navigate(LogoElem,"NEXT")
    If LogoElem Then
        LogoElem = MC.Navigate(LogoElem,"MATCH","LOGO")
```

```
    End If
  Loop
  End If

  Response.Write)"<head><title>" & ChanTitle & "</title></head>")
  If LogoHref Then
     Response.Write("<body><a href=mctp://" & ChanID & ">
        <img src=" & LogoHref & "></a><br>")
  ElseIf ChanTitle and Len(ChanTitle) Then
     Response.Write("<body><a href=mctp://" & ChanID & ">
        <h3>" & ChanTitle & "</h3></a>")
  Else
     Response.Write("<body>")
  End If
```

```
' dump article out best we can
ArtElem = 0
If DataID Then
    ArtElem = MC.Locate(DataID)
End If.
If ArtElem Then
For Blk=0 To 100
    Data = MC.Data)ArtElem,Blk)
    If Not Data.Count Then
        Exit For
    End If
For Field=0 To Data.Count - 1
    Tag = Data(Field) Tag
    Val = Data(Field).Value
    Type = Data(Field).Type
    If Val And Len(Val) Then
        If (StrComp(Type,"Html",l) = 0) Or (StrComp(Type,"Text",1)
        = 0) Then
' output text in standard html
            If Tag And Len(Tag) Then
                Response.Write("<b>" & Tag & ": </b>
            End If
            Response.Write(Val & "<br>" )
        ElseIf StrComp(Type,"Img",1) = 0 Then
' try to create an image
            ImgElem - MC.Locate(Val)
                If ImgElem Then
                    ImgElem = MC.Href(ImgElem)
                    If ImgHref Then
                        Response.Write("<img scr=" & ImgHref
                        & "><br>"
                    End If
                End If
        ElseIf StrComp(Type,"Href",1) = 0 Then
```

```
' write an href
                Response.Write("<a href=" & Val & ">" & Tag & "</a><br>)
                End If
            End If
  Next
  Next
  End If
%>

<br>  <br><hr>
<b>Note:</b> This page was automatically generated because the correct
scripts could not be found.  If this problem persists after
synchronization,
 please contact the content provider.
</body>
</html>
```

APPENDIX B

Mobile Channels Scripting Environment

The Mobile Channels scripting model is based on Active Server Pages (ASP), as defined in IIS. ASP code is written in VBS. In Mobile Channels, both ASP and VBS are scaled down to fit the constraints of Windows CE devices. The streamlined ASP is also known as pocket ASP (pASP). Together, pASP and VBS are referred to as the Mobile Channels scripting environment. The discussions presented here focus on the differences between pASP/VBS for Mobile Channels and ASP/VBS for Active Channels.

Types

There are three legal data types for Mobile Channels scripting: STRING, NUMERIC, and BOOLEAN. However, only STRING is supported internally. The other two are derived from STRING. String literals may be specified using the double quote character (") to bracket the expression. Numeric strings may be specified without quotes. Numbers can be of integers only and their values range between -32,768 and 32767. Boolean expressions evaluate to 1 for true and 0 for false. They may not be assigned to TRUE or FALSE as in Visual Basic. For example,

Data Type	Value	Description
STRING	*"Example string literal"*	
NUMERIC	Result=3+4	The result evaluates to 7. But *Result* is stored as a string value.
BOOLEAN	(a) 3 = 3, (b) 3 = 5	(a) evaluates to 1 and (b) to 0.

Data Structures

Mobile Channels supports the following data structures.

Data Structure	Description
Variable	Elemental data structure of the simple data types presented above. Variable names are alphanumeric and must start with an alpha character. The underscore character can be used except for the leading character. Variable names should be short to conserve memory and can not be longer than 255 characters in any case.
Array	An ordered collections with numeric keys. The index counts from zero (0). For example, Result = a(0)+a(1). The method, **Array.Count** returns the total number of elements in the array.

Keywords

The following keywords are reserved and may not be used as variable names:

If, Then, Else, ElseIf, End If

For, Next, Do While, Loop, Exit For, Exit While

Set, Response, Request, MobileChannels

Now, LocDate, Len, Mid, Split, Asc, Chr, StrComp, Random

Comments

Comments are started with the single quote (') and may appear anywhere on a line. **REM** of VBS is not supported for Mobile Channels scripting. The following is an example of a comment.

```
' this is an example comment.
```

Operators and Precedence

Operator	Type	Precedence	Description
*	Numeric	1	Multiplication
/	Numeric	1	Division
Mod	Numeric	1	Modulo division
+	Numeric	2	Addition
-	Numeric	2	Subtraction
&	String	2	Concatenation
<	Boolean	3	Less than
<=	Boolean	3	Less than or equal to
>	Boolean	3	Greater than
>=	Boolean	3	Greater than or equal to
=	Boolean	3	Equal to
<>	Boolean	6	Not equal to
And	Boolean	4	Logical AND
Or	Boolean	4	Logical OR
Not	Boolean	5	Logical NOT

Expressions are evaluated according to operator precedence. Operators of higher precedence (1 being the highest) get evaluated first. Operators of the

same level are evaluated from left to right. Precedence may be overridden using parenthesis which can be nested. The inner most parenthesis is evaluated first.

Unlike in VBS, all expressions within a statement are always evaluated. In the following example, if *arr.count* is not greater than zero, *arr(1)* and *arr(2)* will be evaluated and the references to *arr(j)* will result in error.

```
If arr.count >0 and arr(1) = "foo" then
  arr(2) = "bar"
End If
```

If the first logical expression is false, the ensuing expressions are invalid. The correct implementation should be as follows.

```
If arr.count > 0 then
  If arr(1) = "foo" then
    arr(2) = "bar"
  End If
End If
```

Escaping Special Characters

Special characters such as the double quote may be "escaped" within a string literal by preceding it with the back slash character (\). The back slash character can be included in a string by escaping it as well. For example,

```
"This is a string that contains \" double quoates\"."
"This is a string that contains back slashes as in a file path: \\c:\\windows."
```

Statements

In the Mobile Channels scripting environment, there are five classes of statements:

Assignment

The assignment statement is of the following form:

```
<variable> = <expression>
```

Conditional

The **If** statement provides conditional flow of control. The **End If** part is required. The statements after a logical expression will not be evaluated unless the logical expression evaluates to true (1). The conditional statement can be one of the following forms:

```
If <logical expression> Then
    <statement>
End If
```

or

```
If <logical expression> Then
    <statement1>
Else
    <statement2>
End If
```

or

```
If <logical expression1> Then
    <statement1>
ElseIf <logical expression2> Then
    <statement2>
End If
```

or

```
If <logical expression1> Then
    <statement1>
ElseIf <logical expression2> Then
    <statement2>
Else
    <statement3>
End If
```

Loop

There are two types of loop statements: **For/Next** and **Do/While**:

The **For** loop iterates through the loop by setting the *variable* initially at numeric *expression1* and incrementing this value by the **Step** amount (*expression 3*) with each pass through the loop. When the optional **Step** clause is omitted, the default clause of **Step** 1 is invoked. The loop terminates when the variable reaches a value greater than *expression2*.

```
For <variable>=<expression1> To <expression2> [Step <expression3>]
   <statements1>
   (Exit For)  ' Optional
   <statements2>
Next
```

The **Do While** loop continues looping until the logical expression, *logExpression* becomes false (0). The **Exit** statements provides a way to terminate a loop without satisfying the normal termination criteria. When **Exit** is encountered, the loop breaks and execution resumes at the statement immediately following the loop. **Exit** is usually used in conjunction with a conditional statement.

```
Do While <logExpression>
   <statements1>
   (Exit While)  'Optional
   <statements2>
Loop
```

Active Server

Active Server statements refer to the methods of pASP objects such as **Response** and **Request**. The **Response.Write** statement returns an output to the HTML stream. For example,

```
Response.Write("<A Href=MCTP://MSNBC/ch2> Click here to jump to Sports </A>").
```

The Mobile Channels scripting environment exposes certain server variables. The **Request.ServerVariables** statement may be used to query the server variables. It takes a name string expression and returns a value string expression associated with the name. So

```
newURL=Request.ServerVariables("URL")
```

obtains the root URL for the channel of the page. And

```
platStr=Request.ServerVariables("Platform")
```

returns the platform string as one of the following:

String	Platform
"WIN32_CE"	Windows CE
"WIN32_WINDOWS"	Windows 95/Windows 98
"WIN32_NT"	Windows NT

Similarly, the **Request.QueryString** statement returns the value of a specified argument passed to the page as part of the URL. For example, if URL for a page is named as "*MCTP://msnbc/ch2 ? city=seattle*", then the statement

```
theCity = Request.QueryString("city")
```

assigns *Seattle* to the *theCity* variable.

Set

The **Set** statement assigns a variable to an instance of an object. However, the Mobile Channels scripting environment supports only the **MobileChannels.Utilities** pseudo object. Thus the only usage of the **Set** statement is to create an **MobileChannels.Utilities** object and assigns it to an instance variable:

```
Set mc_variable = Server.Create("MobileChannels.Utilities")
```

Line breaks are ignored when a statement is evaluated. Thus, statements can wrap to more than one line. The statement continuation character ("_") is recommended, but not mandatory. For example,

```
MyVar = "This is an example of " & _
    "a statement appearing " &
    "on multiple lines." & MyVar
```

Functions

The following functions are exposed in the Mobile Channels scripting environment.

Now

Returns the current date and time and takes no argument. For example,

```
Response.Write("Today's date is " & Now).
```

LocDate

Returns the date using the current regional settings to format the date. For example,

```
Response.Write( "Date: " & LocDate )
```

Len(*<string>*)

Returns the length of a string. For example

```
Len("Hello?")
```

returns 6.

Mid(*aStringExpression, startNumExpression,[length]*)

Returns a sub-string of an existing string. The resulting sub-string is of *length* characters long and begins at the *Start* character number (counting from one, not zero) in the original *string* expression. For example,

```
Foo = Mid("This is my String", 9, 2).
```

Foo is now set to "*my*".

Split(*aStringExpression, delimiterStringExpression*)

Parses a string into sub-strings based on a specified delimiter. The result is returned as an array of strings. For example,

```
Names = Split("Bob;Fred;Joe;",";")
```

results in the following sub-strings:

```
Names(0)="Bob"
Names(1)="Fred"
Names(2)="Joe"
Names(3)=""
```

Asc(*aStringExpression*)

Converts a character string into its numeric ASCII value and returns an numeric expression. If the *aStringExpression* is longer than one character, the function returns the ASCII value of the first character only.

Chr(*numericExpression*)

Converts an ASCII numeric value to the associated character and returns a string expression of one character long. For example, to create a string containing one newline character, use,

```
str = Chr(10)
```

StrComp(*S1*, *S2* [,*Compare*])

This function compares two strings, *S1 and S2*, optionally specifying the comparison mode, *Compare*. The *Compare* argument can be 0 or 1. If *Compare* is omitted, a binary comparison is performed.

This function returns one of the following values:

Condition	Return Value
S1 is less than *S2*	-1
S1 is equal to *S2*	0
S1 is greater than *S2*	1

Random(*range*)

The function generates a random number in the range 0 to one less than *range*. For example,

```
num = Random(10)
```

generates random numbers from 0 to 9 inclusive.

Mobile Channels Scripting Object

MobileChannels.Utilities is a pseudo object in the Mobile Channels scripting environment that provides support for navigation and manipulation of objects within a CDF file. The **Utilities** object provides a

number of methods for Mobile Channels scripting. These methods are summarized in the following table.

Methods	Description
Data	Reads a block of data from a data item
Debug	Emits debug output to aid script development
Href	Returns an element's HREF
HrefExists	Returns true if an item exists in cache
IsSubscribed	Returns subscribed state of a channel/subchannel
IsUnread	Returns read/unread state of item or channel/subchannel
LibraryCall	Accesses a DLL special function
Locate	Jump to a specified ID within the CDF
Navigate	Traverses a CDF file
Tag	Returns the tag of an element in a CDF file
Title	Returns an element's title
Value	Returns the value of an element in a CDF file

To use these services, the **Utilities** object must be instantiated first using the **Set** function as follows:

```
Set MC = Server.Create("MobileChannels.Utilities")
```

MC will be used below as a shorthand for the **MobileChannels.Utilities** scripting object, however, the object may be assigned to any variable name.

Navigate Method of the Utilities Objects

The **MC.Navigate()** command is a powerful, frequently used, and by far the most important method in pASP. It is designed to help examine the structure of a mobile channel, as represented in CDF, at run time. To understand the behavior of this command, a brief discussion of the background and terminology is

helpful.

The basic operand of the **Navigate** command is an element that is the smallest unit of information in a CDF file. Every element has a *tag* and optionally a *value*. The **MC.Tag()** and **MC.Value()** methods of pASP may be used to fetch these strings for any element. The elements are organized into a tree structure as specified by XML as the CDF file is parsed. The **Navigate** command lets us move to specific elements within the tree, and to move between elements with certain relationships. This information can be very useful to the channel scripts which use CDF to dynamically generate the HTML pages for the channel at run time.

The discussions below will refer frequently to the sample CDF file and its associated parse tree, which are provided at the end of this document. The parse tree shows the internal representation of the sample CDF file. Each line of the parse tree is equivalent to an element, and all start with the tag for the element. The more indented elements are children of their less indented parents. Elements at the same level of indentation are siblings. In the CDF file, for example, the **BASE** element is a child of the top-level **CHANNEL** element. The first **HREF** element is a sibling of the **BASE** element. The **INTERVALTIME** element is a child of the **SCHEDULE** element.

Many elements are considered to have a default value. These are indicated in the parse tree by an "= [*string*]" expression following the tag of the element. The default value is determined in the following scheme. First, if the element under consideration has a string directly associated with it, the string is

the default value. Next, if there is a child **VALUE** element, the child's value becomes the default one. If no **VALUE** element is provided, but a child **HREF** element is found, its value becomes the default value. If none of these can be found, the **VALUE** is empty. For example, the value of the first **ID** tag is a direct string, the **TITLE** tag has an explicit **VALUE** element, so this is used, and the value of first **LOGO** tag is its **HREF**. The **SCHEDULE** tag has no direct string, **VALUE** or **HREF** children, so its value is empty.

The **Navigate** function has the following syntax:

```
NewElem = MC.Navigate( StartElem, NavAction, [,Match] )
```

The function returns a new element, or 0 if the command could not find the specified element. You may test this return value using standard VBS comparisons such as:

```
IF NOT NewElem THEN
  ' not found
END IF
```

The *StartElem* parameter is the starting element from which to base relative movement commands. If you are using the absolute movement command "*Jump*", you must use "" for the *StartElem* parameter. But in all other cases it must be a valid element returned from a previous **Navigate()** command.

The *NavAction* parameter must be one of the following strings:

"*Jump*"

The "*Jump*" action is the first command used to get a starting element. It is equivalent to the **MC.Locate()** command (see below). The *StartElem* parameter must be an empty string. The "*Jump*" action navigates directly to a specific element in the CDF as identified by the supplied ID. For example, the following statement,

```
NewElem = MC.Navigate( "", "Jump", "D1" )
```

jumps to the first data item element in the example CDF file. The *NewElem* will be the **ITEM** parent element to the **ID** element ("D1", about halfway down in the example CDF file).

"*First*"

The "*First*" action moves to the first element at a given level. For example, from the **ID** element of the first **LOGO** element in the example CDF file, a "*First*" action will move to the **STYLE** tag of that **LOGO**. More practical scenarios are to use this action to go back to the beginning of the list of **ITEM**s under a subchannel.

```
NewElem = MC.Navigate( StartElem, "First" )
```

"*Out*"

The "*Out*" action moves to the parent element from the current element, or to the left one indent in the parse tree diagram. For example, from the **TITLE** element of the example CDF, the "*Out*" action will result in the movement to the top-level channel element.

```
NewElem = MC.Navigate( StartElem, "Out" )
```

"*In*"

The "*In*" action moves to first child element beneath the current element. For example, from the first **USAGE** element in the example CDFfile, the "*In*" action will result in a movement to the **VALUE** element.

```
NewElem = MC.Navigate( StartElem, "In" )
```

"*Prev*"

The "*Prev*" action moves to the element at the same level immediately previous to the current element. If it does not find a previous element at the same level, it will return 0; it will not next out to the parent element. For example, if from the **BASE** element in the example CDF file, the "*Prev*" action will result in a move to the HREF element right before it. Calling "Prev" again will return 0 since there are no more siblings at this level.

```
NewElem = MC.Navigate( StartElem, "Prev" )
```

"*Next*"

The "*Next*" action moves to the next element at the same level. As with the "*Prev*" action, if it finds no such sibling element, it returns zero. For example, from the first **LOGO** tag in the example CDF file, the "*Next*" action will result in a move to the second **LOGO** element.

```
NewElem = MC.Navigate( StartElem, "Next" )
```

"*Match*"

The "*Match*" action attempts to find a sibling element with a tag matching the specified match string. It will traverse as many siblings as it needs to until it either finds a match or can find no more siblings. If the "*Match*" action starts from a matched element, it will simply return the current element. To match beyond the current element, the "*Match*" action must follow a "*Next*" action.

```
NewElem = MC.Navigate( StartElem, "Match", "TagToMatch" )
```

"*InMatch*"

The "*InMatch*" action is the same as "*Match*" above except it begins its search at the first child of the current element. This can be useful for looking for specific subtags which modify the enclosing element. For example, the following statements,

```
UsageElem = MC.Navigate( StartElem, "InMatch", "USAGE" )
If UsageElem Then
  UsageVal = MC.Val( UsageElem )
  ' test for specific usage...
End If
```

look for the **USAGE** tag for a specific item.

The only actions that use the optional third parameter are "*Match*" and "*InMatch*".

Other Methods of the Utilities Object

Tag

This method returns the tag name of an element:

```
tagString=MC.Tag(elementID)
```

Value

This method returns the value of an element:

```
valString=MC.Value(elementID)
```

Data

This method gets data from a Mobile Channels data file and returns an array of name-value pairs based on the current location and the specified block number. The names are the field names as specified in an **ITEMFORMAT** statement and the values are the data items (lines) as fetched from the data file. In the following example, *dataItems* is an array to hold the data items.

```
dataItems =MC.Data(elementID, blockNum)
```

where *elementID* is the current location within the CDF file, for example, the **ID** item for the MCD file, and *blockNum* is the block number within the file. Blocks start with zero. So the first repeating block, if present, is always block number one (even if there is no header). The resultant array, *dataItems*, contains an element for each item (line) within the block. The items in a block counts from zero.

Each data item is, in effect, an object that supports the **Tag**, **Type**, and **Value** methods to expose its own properties.

Tag

dataItems(index).Tag returns the field name for the indexed array position, as declared in the **<ITEMFORMAT>** element.

Value

dataItems(index).Value returns the value of the field for the indexed array position.

Type

dataItems(index).Type returns the type as specified in the **<ITEMFORMAT>** statement. If no type is listed or if the <ITEMFORMAT> tag is missing, then the Type method returns "HTML". Other types include "TEXT", "IMG", and "HREF".

Type	Description
HTML	The line item is HTML formatted content. This is the default type.
HREF	The line is a URL, (either http:// or mctp://).
IMG	The line contains the ID of an image item in the CDF file.
TEXT	Same as HTML.

Locate

The function is of the following form:

```
newElem = MC.Locate("ID")
```

and is a shorthand for the "*Jump*" action of the **Navigate** method:

```
newElem = MC.Navigate( "", "Jump", "ID" )
```

LibraryCall

This function allows a script to access a custom DLL to perform functions not available through standard scripting. The method is of the following form:

```
Result = MC.LibraryCall( LibName, FuncName [,param]* )
```

First, the method checks for security to verify that the DLL has been properly registered for access via pASP scripting. An accessible DLL must have a registry entry in **\HKLM\Software\Microsoft\Mobile Channels\Components**, matching the name of the DLL.

Then the **LibraryCall** method dynamically loads the specified DLL by calling the **GetProcAddress** function to look up the specified function. Any additional parameters are then marshalled before being forwarded to the DLL function. Up to 8 optional parameters may be passed.

The DLL function must return a LPWSTR value. If the return value is NULL, **LibraryCall** returns zero (0). Otherwise, it returns the string itself as a standard pVBS string value.

Debug(*Mesg*)

The **Debug** method allows a debug string to be written out during the execution of the script. This may be useful during development to help examine program flow. The debug messages will appear in the console window of any attached debugger, similar to the **OutputDebugString** API.

The function does not return any value.

HrefExists(*Href*)

This method tests to determine whether the specified URL can be found in cache. This allows a script to gracefully handle missing images, data elements, or other components needed by the script. The URL must be a fully qualified http-style URL.

This method returns 1 if found in cache, else 0.

Href(*Elem*)

This method returns the full URL for the specified element if it is specified in the CDF file. It returns 0 if no URL can be found.

IsSubscribed(*ChanElem*)

This tests to see if the specified channel or subchannel element is currently subscribed to by the user. It returns 1 if the channel is subscribed, or 0 if it is not found or not subscribed.

Note: this will not work on items, only on channels. Furthermore, it always returns 1 when running on the desktop (in IE4).

Title

This method is of the following form:

```
titleString = MC.Title( ElemString )
```

and it attempts to decipher the title of a given element by the following means:

If there is an explicit **TITLE** tag for this element, the value of that is returned,

If it is an *.mcd* data item with an **ITEMFORMAT** specifying a **TITLE** field, the data item is opened and the title extracted therefrom,

If an **ID** element is provided, its value is returned,

If anything else, NULL is returned.

Note that this method does not mark a data item as "Read" as it fetches the title. This is different from using **Navigate** to get the title. The latter method marks the item as "Read", even if the user has not actually looked at it.

IsUnread

This method returns a boolean indicating whether the associated item or channel has been read.

```
newContent = MC.IsUnread( Elem )
```

The function returns non-zero value if called directly on an unread item. When called on a subchannel, it will return non-zero if any items *or other subchannels* within the subchannel have not been read.

SetUnread

This method sets the read/unread state for an item and returns no value. And it is of the following format.

```
SetUnread(Elem [,Flag])
```

The *Elem* parameter should be a valid element from a prior **Navigate()** or **Locate()** call. The optional *Flag* parameter is a boolean used to mark the state of *Elem*: 0 for "unread" and 1 for "read". The default value of *Flag* is "unread".

Note Due to a limitation of the version 1.0 implementation of Mobile Channels, image items do not get marked as "read" automatially (as do MDC items). This results in the image remaining marked as "unread" even though it has been read. Further, all the parent subchannels will also show as "unread" as long as any images within are unread. To remedy this situation, the script author should manually mark each image as "unread" each time it is displayed. The **SetUnread()** utility is the correct way to achieve this.

Channel Browser and Active Desktop HTML Extensions

Several HTML extensions provide additional functionality for writing more advanced scripts for Active Desktop and for controlling page updates in Channel Browser.

Application Links

Windows CE Active Desktop supports a special HTML Href for launching an application from a hyperlink. The format is:

```
<A HREF="mcexe://[appname]">Launch Text</A>
```

appname is the name of the application to be launched when the link is clicked.

The application must have been registered by placing a value of the same name as the .exe in the registry at **\HKLM\Software\Microsoft\Mobile Channels\Components**.

META Tags

Channel Browser and Active Desktop recognize the following special META tags. Embedding these META tags in the header of a page, either directly or via scripting can cause the page to be automatically handled or updated in a particular manner. Note that these META tags (with the exception of *Refresh*) are ignored by IE4.

The META tags are summarized in the following table.

Http_Equiv	Description	Support
Notify	Catch cache or database updates	Active Desktop and Channel Browser.
Refresh	Reload after time interval	Active Desktop
LaunchApp	Execute application for desktop component	Active Desktop
Autosize	Control image scaling	Channel Browser

The following are some detailed discussions of each tag.

Notify

This META tag allows a page to be automatically updated when there is an update to a particular database, or when a particular item is updated in cache. This can be used to regenerate a page automatically when a new version of it (or one of its components) comes in via sync or other mechanism. The two forms of this META tag are:

```
<META HTTP-EQUIV="Notify"
    CONTENT="DBUPDATE=[DBname];URL=[RefreshUrl]">
<META HTTP-EQUIV="Notify"
    CONTENT="CACHEUPDATE=[WatchUrl];URL=[RefreshUrl]">
```

DBname is the name of the database to monitor for updates.

WatchUrl is the URL of an item to watch for cache updates on.

RefreshUrl is the URL to load if an update is detected.

Refresh

This META tag causes a page to be automatically reloaded after a specified time interval. The form is:

```
<META HTTP-EQUIV="Refresh" CONTENT="[secs];URL=[RefreshUrl]">
```

secs sets the number of seconds until the page will be reloaded.

RefreshUrl is the URL to load after the specified interval.

LaunchApp

This META tag allows an application to be launched by clicking on the header of an Active Desktop component on the device. The form is:

```
<META HTTP-EQUIV="LaunchApp" CONTENT="[appname][?params]">
```

appname is the name of the executable to launch.

params is an optional comma separated list of *params* to be passed to the application upon invocation

The application must have been registered by placing a value of the same name as the **.exe** in the registry in **\HKLM\Software\Microsoft\Mobile Channels\Components**.

Autosize

This META tag allows the default image scaling behavior to be disabled for a particular page. The HTML control will, by default, attempt to scale images for display on the smaller form factor screen. However, if this META is specified in the page header the images will displayed at the full size causing scrollbars to appear if needed. The form is:

```
<META HTTP-EQUIV="Autosize" CONTENT="Off">
```

Note that since the default value is always "On" there is no need for any other value in the CONTENT field.

Example CDF File

```
<?XML version="1.0"?>
<CHANNEL
  HREF="mctp://mySite/34droad/34droad.cdf "
  BASE="http://mySite/" ID="34droad">
  <SELF HREF="http://mySite/34droad/34droad.cdf" />
  <SCHEDULE><INTERVALTIME MIN="40"/></SCHEDULE>
  <USAGE VALUE="MobileChannel"/>
  <TITLE>3 4 D Road</>
  <ABSTRACT>Things to think about while you're away...</>
  <LOGO STYLE="IMAGE" HREF="34droad/34logo.gif" ID="LOGO"/>
  <LOGO STYLE="ICON"  HREF="34droad/34icon.gif" ID="ICON"/>
  <CHANSCRIPT VALUE="SS"/>
  <ITEMSCRIPT VALUE="SS"/>
  <ITEM HREF="34droad/34.mcs" ID="SS">
    <ABSTRACT>Things to think about while you're away...</>
  </ITEM>
  <ITEM HREF="cgi-bin/deep1.mcd?1" ID="D1">
    <USAGE VALUE="MobileChannel"/>
    <LOG VALUE="document:view"/>
  </ITEM>
  <ITEM HREF="cgi-bin/deep1.mcd?2" ID="D2">
    <USAGE VALUE="MobileChannel"/>
    <LOG VALUE="document:view"/>
  </ITEM>
  <ITEM HREF="cgi-bin/deep1.mcd?3" ID="D3">
```

```
    <USAGE VALUE="MobileChannel"/>
    <LOG VALUE="document:view"/>
  </ITEM>
  <ITEM HREF="34droad/34logo.gif" ID="LOGO">
    <USAGE VALUE="None"/>
  </ITEM>
  <ITEM HREF="34droad/34icon.gif" ID="ICON">
    <USAGE VALUE="None"/>
  </ITEM>
  <ITEM HREF="34droad/34main.gif" ID="MGIF">
    <USAGE VALUE="None"/>
    <LOG VALUE="document:view"/>
  </ITEM>
</CHANNEL>
```

Parse Tree of the example CDF file

```
CHANNEL = mctp://mySite/34droad/34droad.cdf
  HREF = mctp://mySite/34droad/34droad.cdf
  BASE = http://mySite/
  ID = 34droad
  SELF = http://mySite/34droad/34droad.cdf
    HREF = http://mySite/34droad/34droad.cdf
  SCHEDULE
    INTERVALTIME
      MIN = 40
  USAGE = MobileChannel
    VALUE = MobileChannel
  TITLE = 3 4 D Road
    VALUE = 3 4 D Road
  ABSTRACT = Things to think about while you're away...
    VALUE = Things to think about while you're away...
  LOGO = 34droad/34logo.gif
    STYLE = IMAGE
    HREF = 34droad/34logo.gif
    ID = LOGO
  LOGO = 34droad/34icon.gif
    STYLE = ICON
    HREF = 34droad/34icon.gif
    ID = ICON
  CHANSCRIPT = SS
```

WHAT IS CLAIMED IS:

1. A computer readable medium including instructions readable by a computer which, when implemented, cause the computer to handle information by performing steps comprising:

storing a content structure file, a data file and a script file, the data file including data indicative of the information and the script file including script information indicative of a desired form in which the data is to be rendered, the content structure file, data file and script file being independently receivable by the computer;

reading the content structure file to ascertain which script in the script file is associated with data to be rendered; and

retrieving the data from the data file and executing the associated script in the script file to render the data.

2. The computer readable medium of claim 1 including instructions readable by a computer which, when implemented, cause the computer to handle information by performing steps comprising:

storing a first script file and a second script file; and

wherein reading the content structure file to ascertain which script includes examining the first script file for the associated script and wherein executing includes executing another script from the second script file if the associated script is not found.

BNSDOCID: <WO___9935593A1_I_>

3. The computer readable medium of claim 1 including instructions readable by a computer which, when implemented, cause the computer to handle information by performing steps comprising:

storing a preference file having information regarding data to be stored in the data file; and

intermittently receiving updated data and reading the preference file to ascertain if the updated data is to be stored in the data file.

4. The computer readable medium of claim 3 wherein the content structure file includes preference tags associated with default preferences, and wherein storing a preference file includes reading the preference tags.

5. The computer readable medium of claim 4 including instructions readable by a computer which, when implemented, cause the computer to handle information by performing steps comprising:

changing the information in the preference file.

6. The computer readable medium of claim 1 wherein the content structure file includes references to data and scripts in a hierarchy.

7. The computer readable medium of claim 6 wherein reading the content structure file to ascertain which script in the script file is associated with the data to be rendered includes choosing the script as a function of the hierarchy.

8. The computer readable medium of claim 7 wherein the content structure file includes script tags associated with scripts in the script file, the script tags being in the hierarchy.

9. The computer readable medium of claim 8 wherein choosing the script file includes choosing a script referenced by a script tag in a higher portion of the hierarchy for data to be rendered in a lower portion of the hierarchy if there is no associated script tag for the data in the lower portion of the hierarchy.

10. The computer readable medium of claim 1 wherein executing the script comprises rendering the data in a processor independent form.

11. The computer readable medium of claim 10 wherein executing the script comprises rendering the data in hypertext markup language (HTML) form.

12. The computer readable medium of claim 10 wherein the computer comprises a mobile device, and wherein storing the content structure file, data file and script file includes receiving the content structure file, data file and script file from the desktop computer.

13. A method for rendering information on a computer comprising:

storing a content structure file, a data file and a script file on the computer, the data file including data indicative of the information and the script file including script information indicative of a desired form in which the data is to be rendered, the content structure file, data file and script file being independently receivable by the computer;

reading the content structure file to ascertain which script in the script file is associated with data to be rendered; and

retrieving the data from the data file and

executing the associated script in the script file to render the data.

14. The method of claim 13 and further comprising storing a first script file and a second script file; and wherein reading the content structure file to ascertain which script includes examining the first script file for the associated script and wherein executing includes executing another script from the second script file if the associated script is not found.

15. The method of claim 13 and further comprising:

storing a preference file on the computer having information regarding data to be stored in the data file; and

intermittently receiving updated data and reading the preference file to ascertain if the updated data is to be stored in the data file.

16. The method of claim 15 wherein the content structure file includes preference tags associated with default preferences, and wherein storing a preference file includes reading the preference tags.

17. The method of claim 16 and further comprising changing the information in the preference file.

18. The method of claim 13 wherein the content structure file includes references to data and scripts in a hierarchy.

19. The method of claim 18 wherein reading the content structure file to ascertain which script in the script file is associated with the data to be rendered includes choosing the script as a function of the hierarchy.

20. The method of claim 19 wherein the content

structure file includes script tags associated with scripts in the script file, the script tags being in the hierarchy.

21. The method of claim 20 wherein choosing the script file includes choosing a script referenced by a script tag in a higher portion of the hierarchy for data to be rendered in a lower portion of the hierarchy if there is no associated script tag for the data in the lower portion of the hierarchy.

22. The method of claim 21 wherein executing the script comprises rendering the data in a processor independent form.

23. The method of claim 22 wherein executing the script comprises rendering the data in hypertext markup language (HTML) form.

24. The method of claim 22 wherein the computer comprises a mobile device, and wherein storing the content structure file, data file and script file includes receiving the content structure file, data file and script file from the desktop computer.

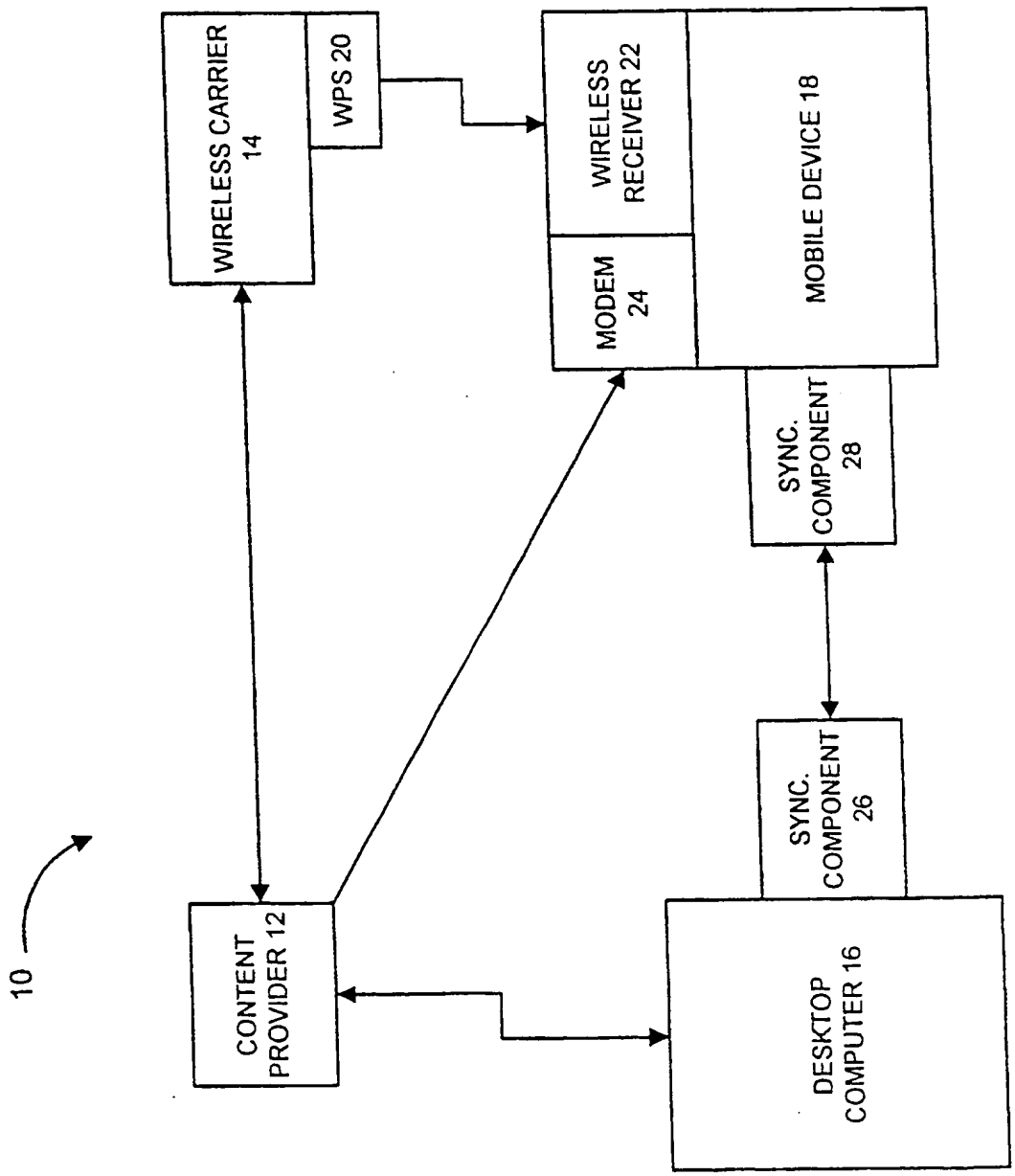


FIG. 1

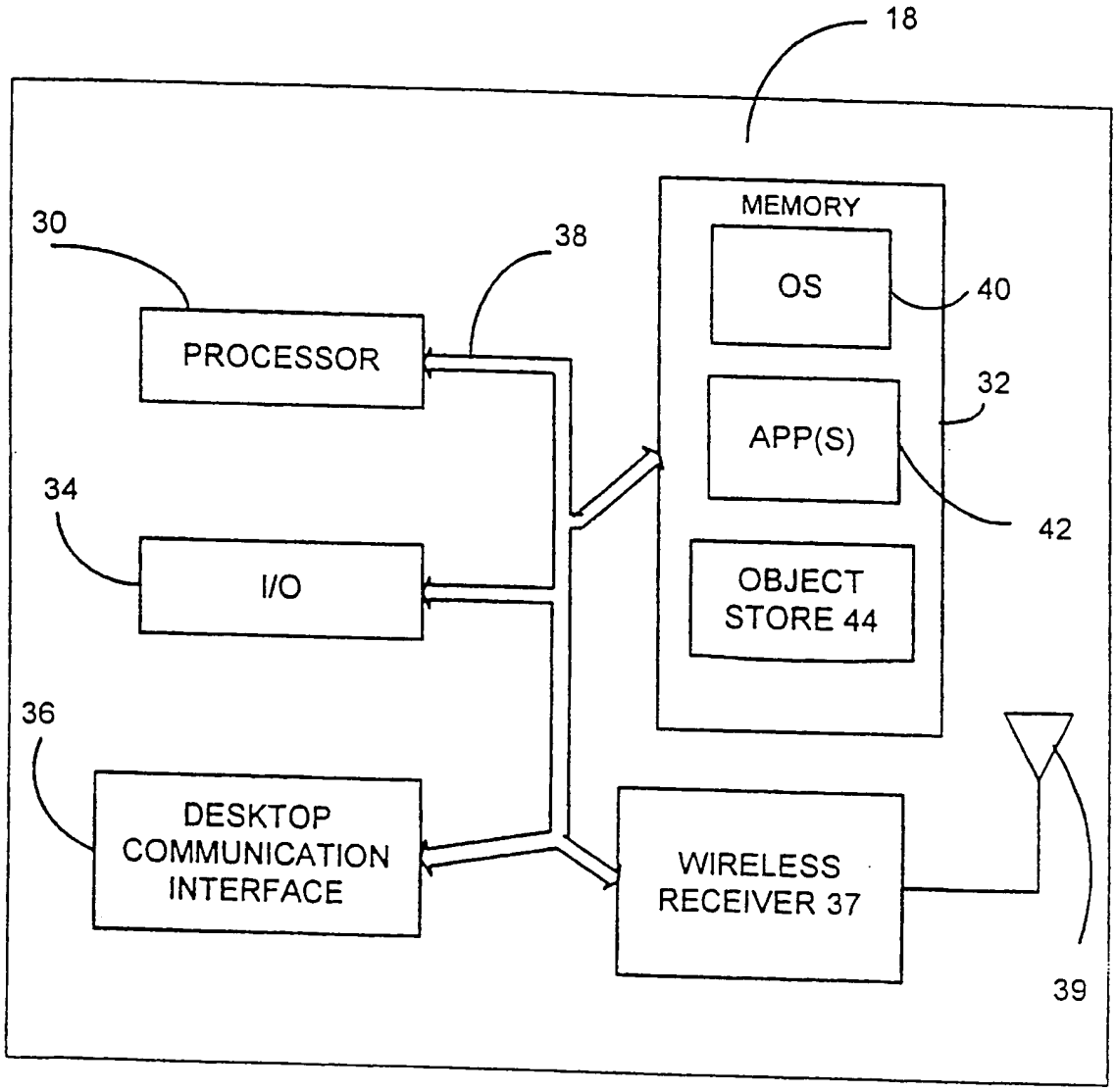


FIG.2

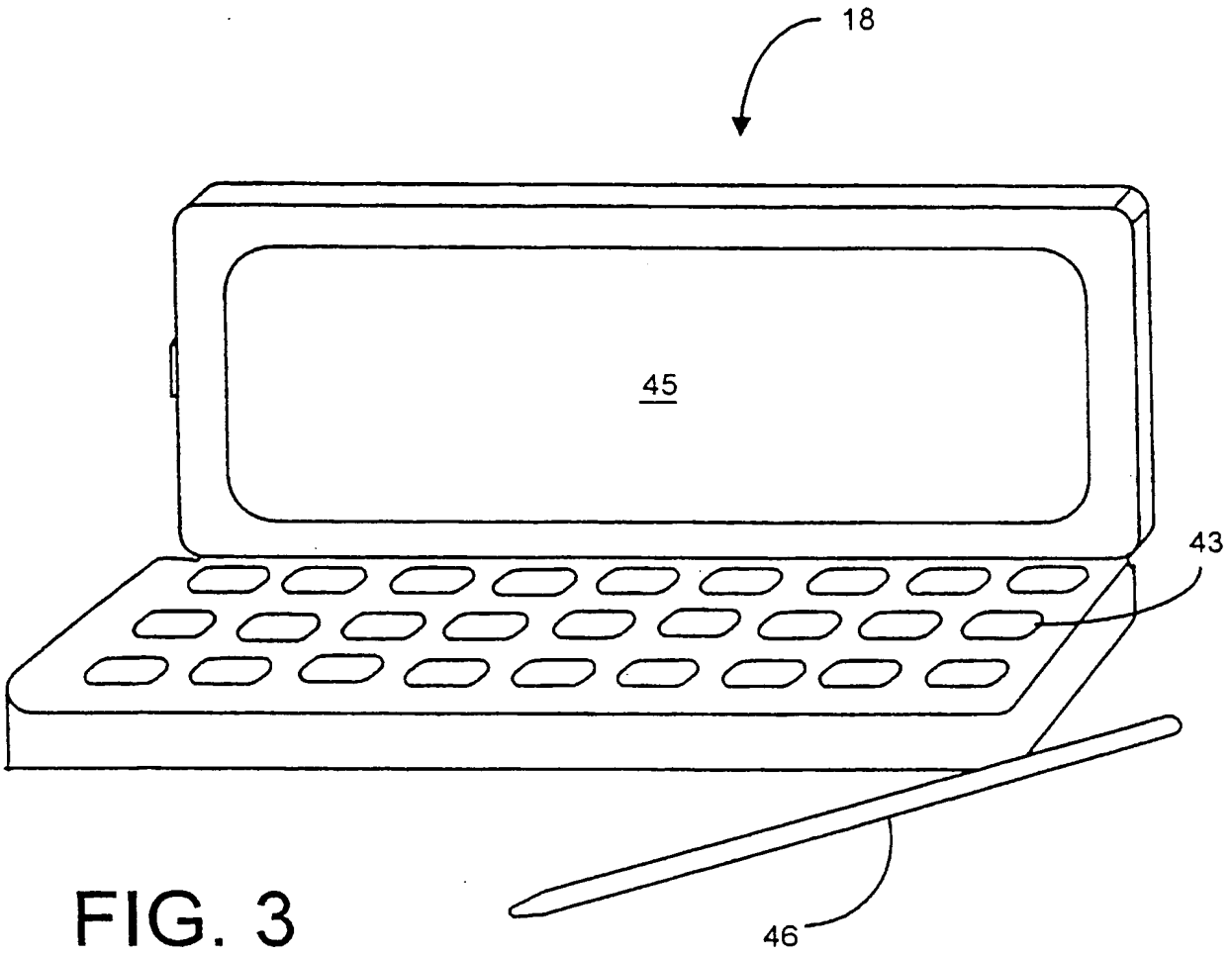


FIG. 3

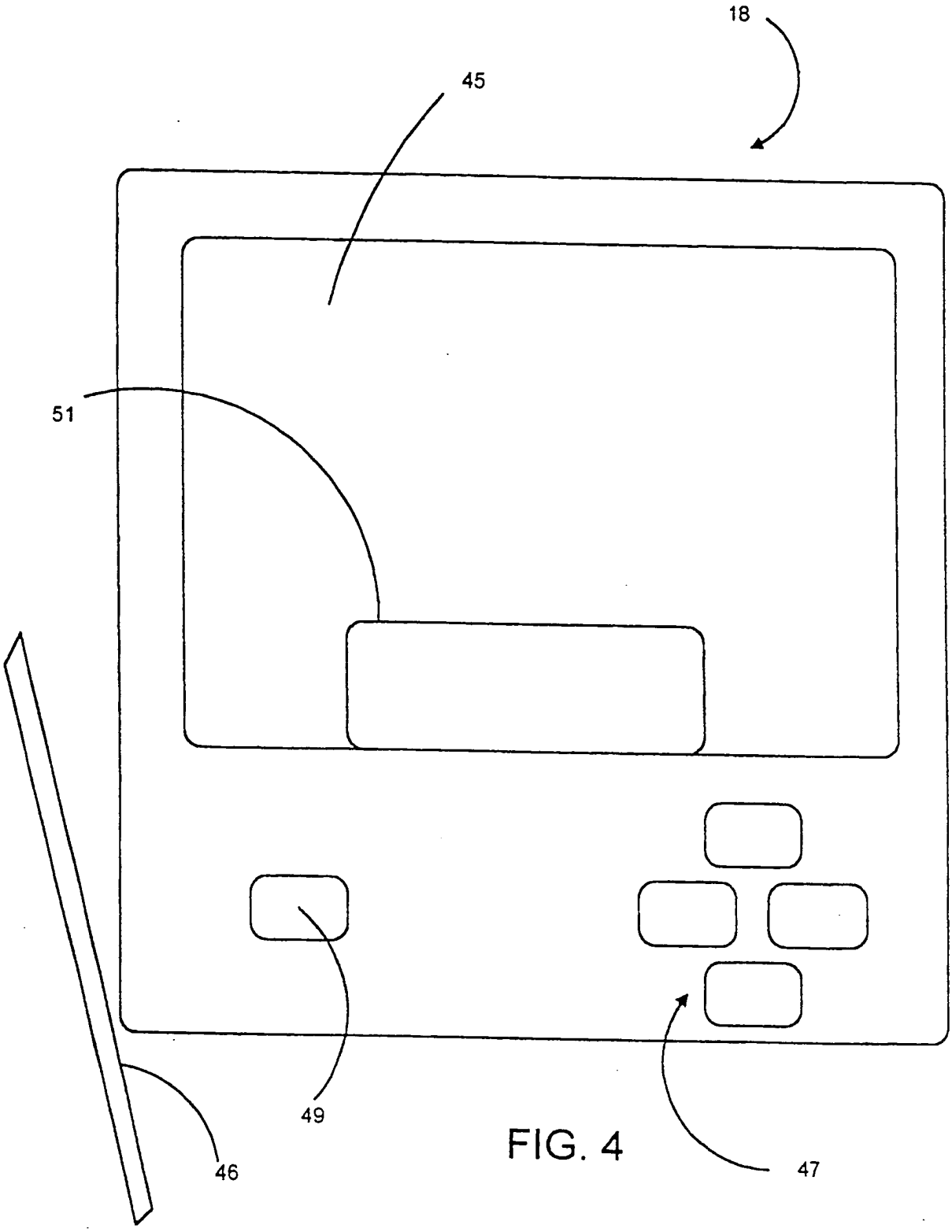
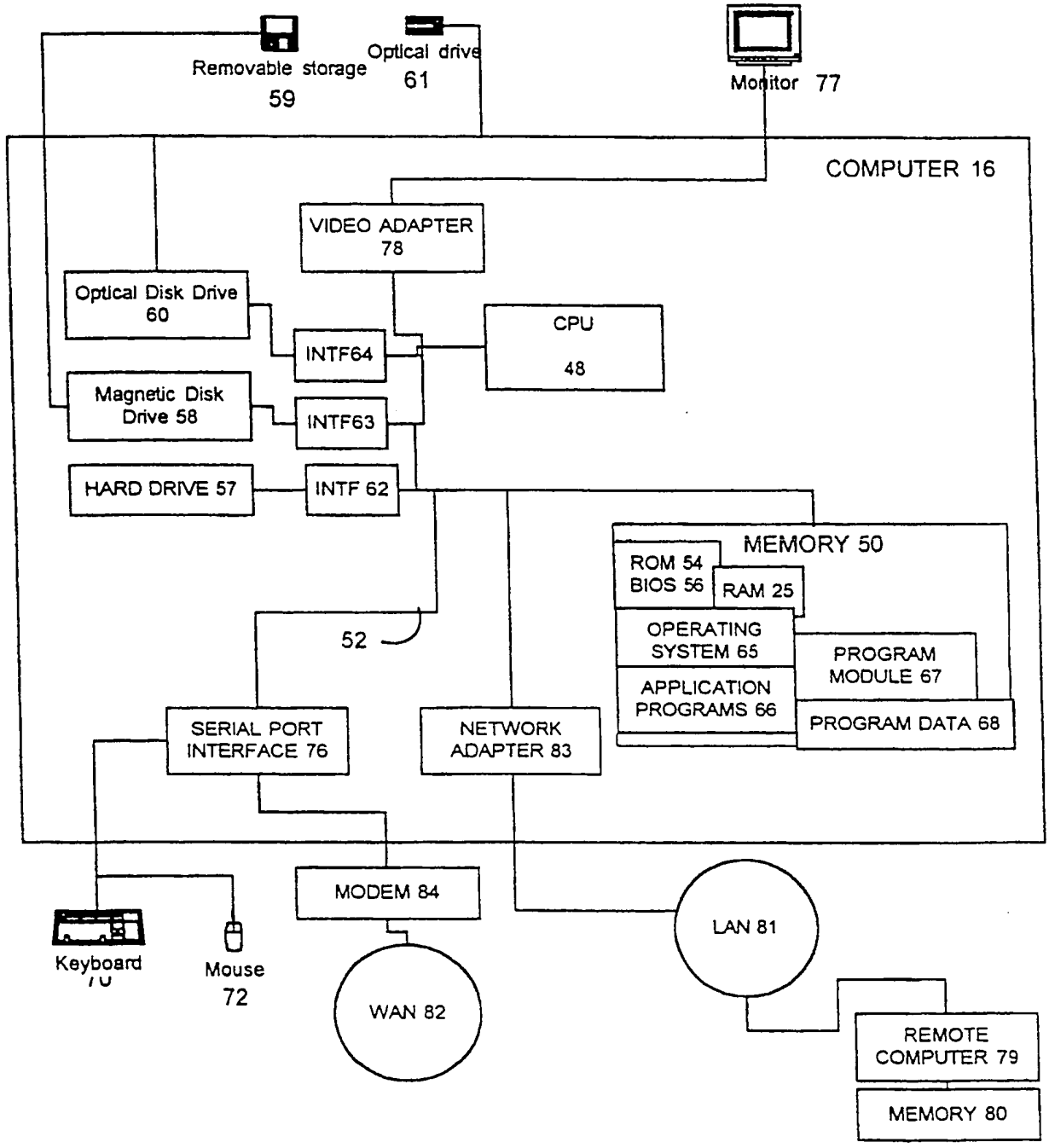


FIG. 4

FIG. 5



SUBSTITUTE SHEET (RULE 26)

FIG. 6

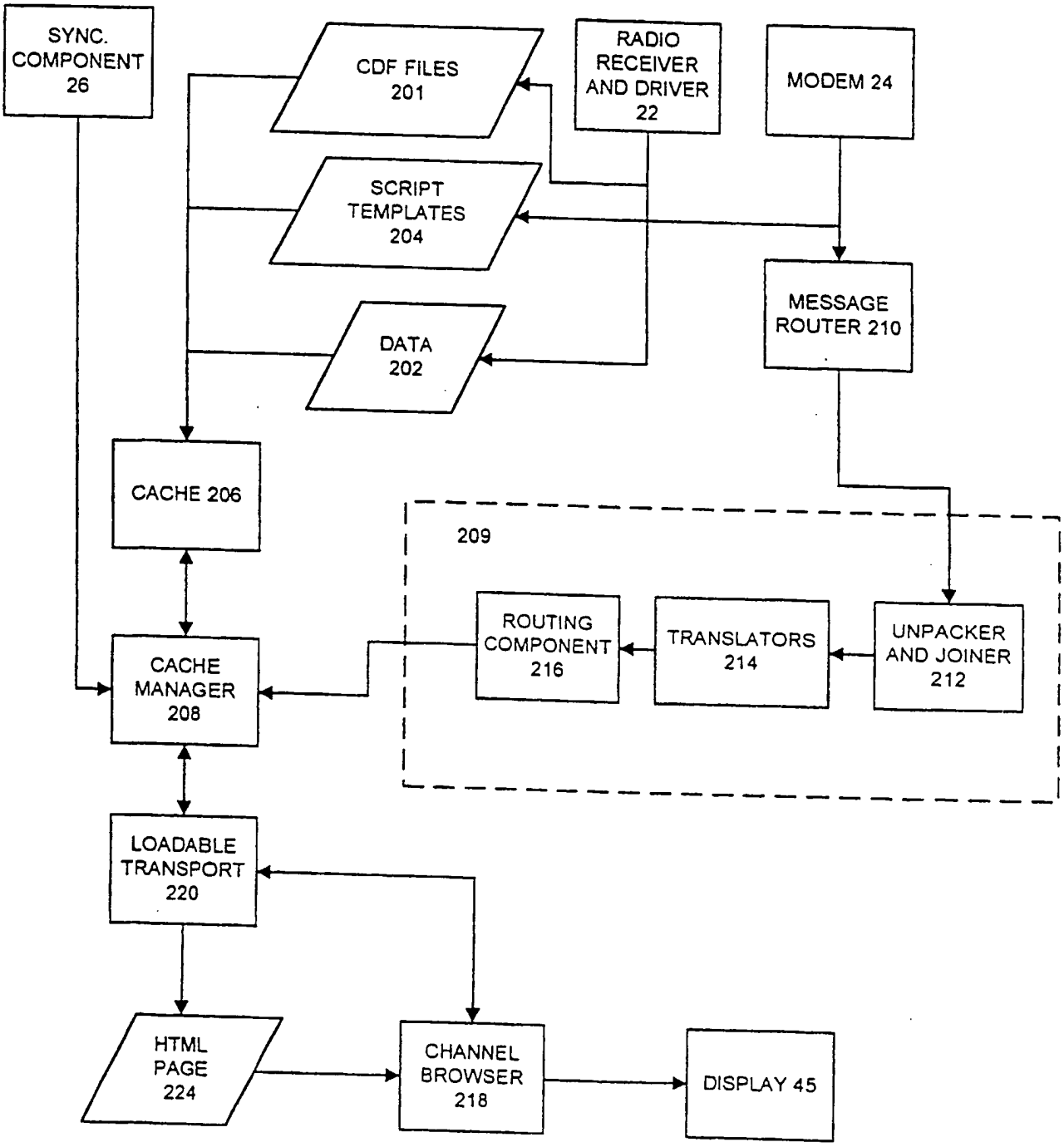
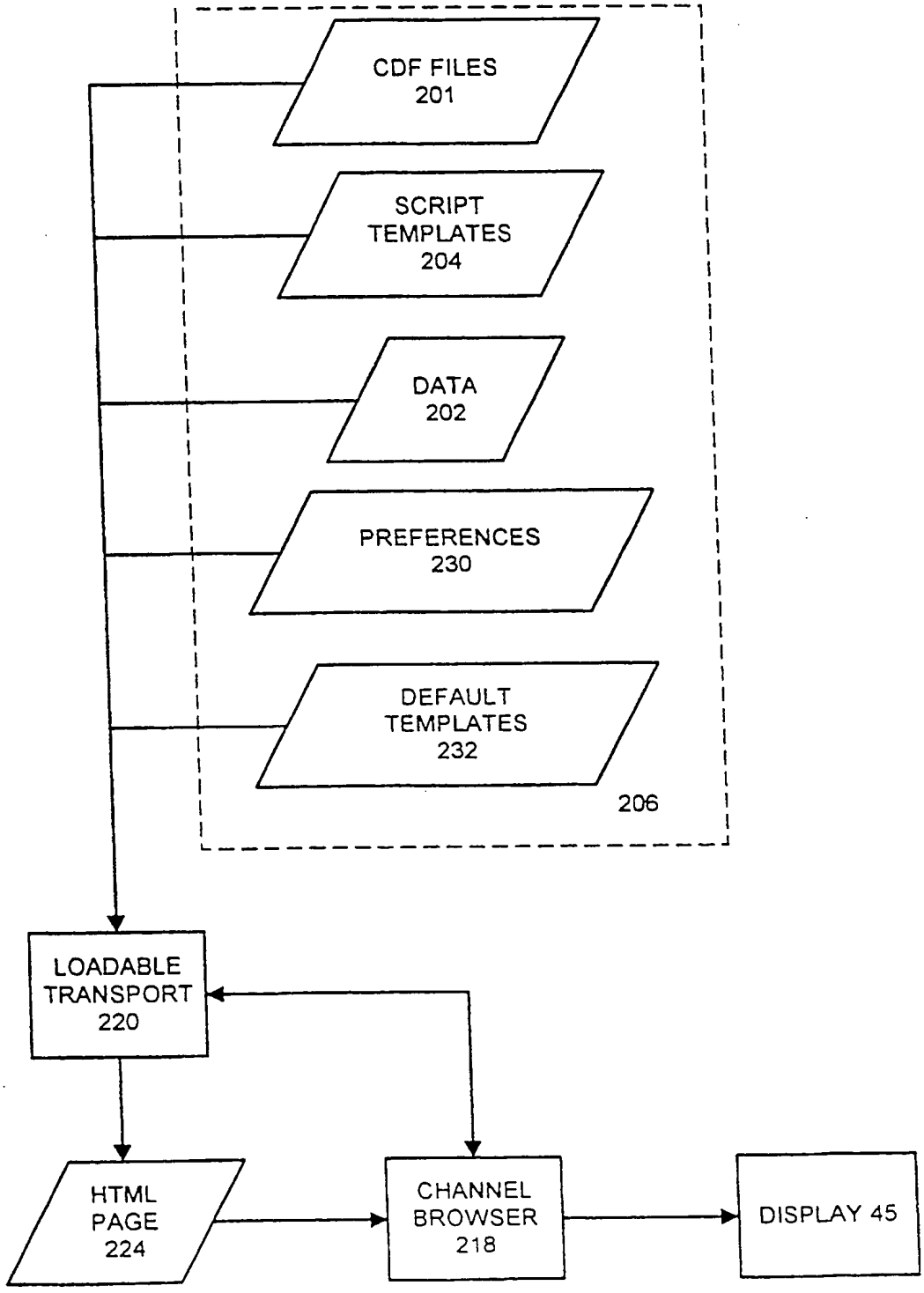


FIG. 7



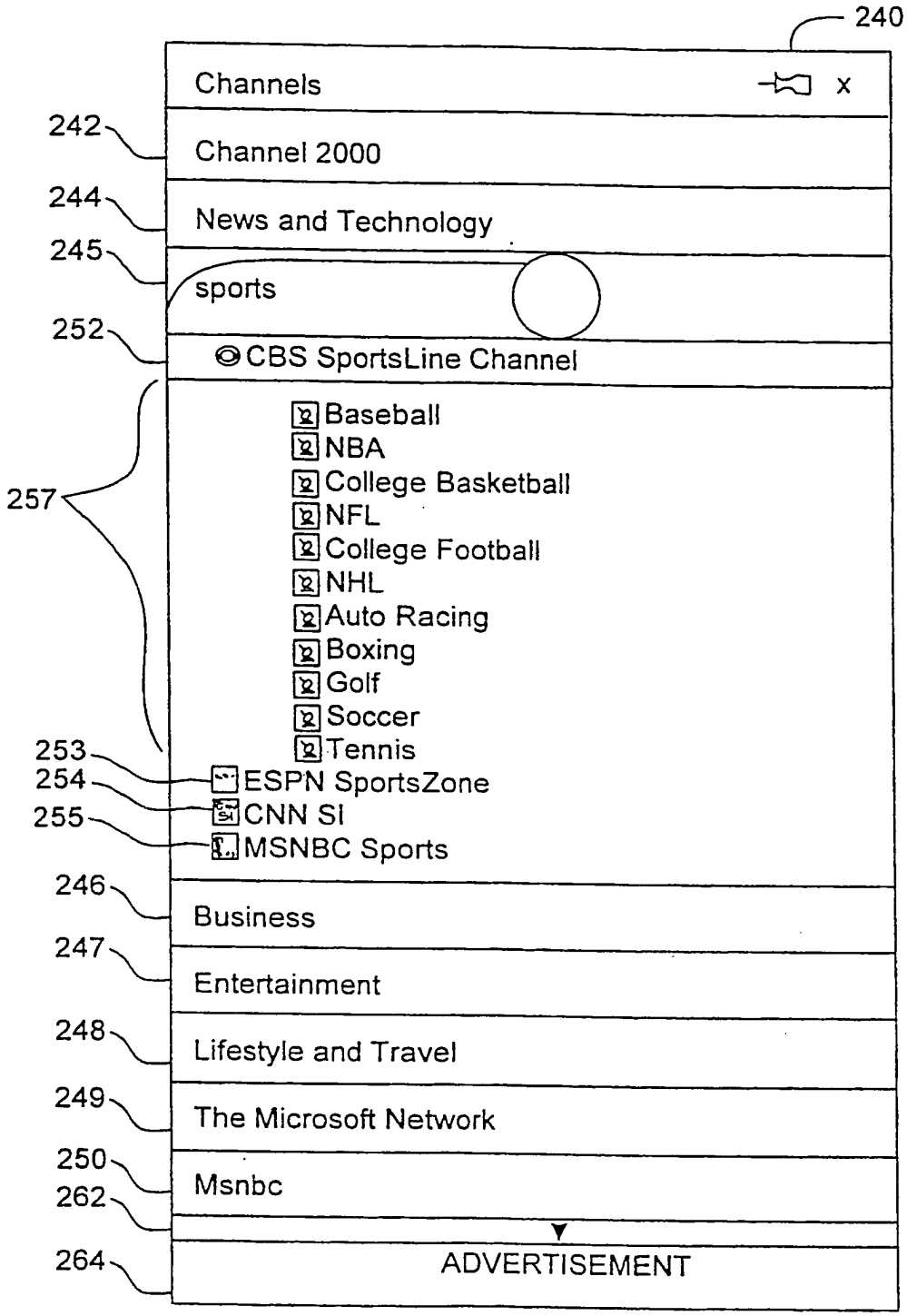


FIG. 8

INTERNATIONAL SEARCH REPORT

Inte 'onal Application No
PCT/US 99/00279

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 G06F17/22 G06F17/21

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CASTEDO ELLERMAN: "Channel Definition Format (CDF)" CHANNEL DEFINITION FORMAT SUBMISSION 970309,10 March 1997, XP002103294 http://www.w3.org/TR/NOTE-CDFsubmit.html see the whole document ---	1,13
A	JASON LEVITT: "Push Your Web Pages -- Netscape's Netcaster and Microsoft's CDF make it easier than ever to join the push revolution" INFORMATION WEEK, no. 634, 9 June 1997, XP002103295 http://www.techweb.com/se/directlink.cgi?IWK19970609S0047 see the whole document --- -/--	1,13

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 May 1999	01/06/1999

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Wiltink, J

1

INTERNATIONAL SEARCH REPORT

Int ional Application No
PCT/US 99/00279

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category `	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	VITALI F ET AL.: "Extending HTML in a principled way with displets" COMPUTER NETWORKS AND ISDN SYSTEMS, vol. 29, no. 8-13, 1 September 1997, page 1115-1128 XP004095309 see abstract see page 1118, left-hand column, line 1 - page 1127, left-hand column, line 20 ---	1,13
A	SALAMPASIS M ET AL: "HYPER TREE: A STRUCTURAL APPROACH TO WEB AUTHORING" SOFTWARE PRACTICE & EXPERIENCE, vol. 27, no. 12, 1 December 1997, pages 1411-1426, XP000726053 see abstract see page 1413, line 13 - page 1420, line 19; figures 1-5 ---	1,13
A	EP 0 803 825 A (MATSUSHITA ELECTRIC IND CO LTD) 29 October 1997 see abstract see column 2, line 55 - column 7, line 19 see claim 1 -----	1,13

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATION SEARCH REPORT

Information on patent family members

Int ional Application No
PCT/US 99/00279

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0803825 A	29-10-1997	JP 9293144 A	11-11-1997
		AU 696427 B	10-09-1998
		AU 1910797 A	30-10-1997
		CA 2202083 A	26-10-1997